From: Tom Moore <Tom.Moore@noaa.gov>
Subject:
Date: October 29, 2010 10:18:53 AM EDT
92 Attachments, 33.5 MB

Begin forwarded message:

> **From:** Chris Doley <Chris.Doley@noaa.gov>
> **Date:** April 27, 2010 1:19:53 PM EDT
> **To:** Brian Hostetter <Brian.Hostetter@noaa.gov>
> **Cc:** Cheryl Brodnax <Cheryl.Brodnax@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>, 'Leslie Craig' <Leslie.Craig@noaa.gov>
> **Subject: Re: DR L TASKER #5**
>
> Brian - This seems to be the level of info that we need but I need you to rework so it explains the typical types of injuries that may result. Something like the following:
>
> "It is difficult to predict the specific impacts. However, past oil spills in the area have resulted in multiple injuries. For example, sea floor injuries from discharged oil may result injury to benthic invertebrates, demersal fishes, pelagic fishes, and marine mammals. These injuries result from the released oil smothering and coating of benthic resources and ingestion by animals that feed on benthic resources and demersal fishes in the affected area. Contact with oil or ingestion of oil or oiled prey may have acute or chronic effects on these organisms, including physical effects (such as smothering) and toxicological effects. Additionally, the presence of discharged oil in the environment may cause decreased habitat utilization of the area, altered migration patterns, altered food availability, and disrupted life cycles. Natural resource services that may be affected by the oil discharge include, but are not limited to, chemical exchange across the interface between the sea floor and the water column, decomposition and use of organic matter by benthic microalgae and other fauna, primary production, and habitat utilization by benthic and demersal fauna."
>
> Thanks
> Chris
>
> Brian Hostetter wrote:
>
>> Chris, staff felt that the most applicable cases inre to surface/in water habitat consequences to living resources in the Gulf would be DBL 152 and Lake Barre (settled 15 Nov 99).
>>
>> From DBL-152 Draft DARP/EA related to water column injury (not surface injury since this was heavy oil). Use of dispersants was also not an issue with DBL-152:
>>
>> "The majority of discharged oil was denser than sea water. As a result of its density, upon release it sank to the seafloor. Injury to benthic invertebrates, demersal fishes, pelagic fishes, and marine mammals may have resulted from the released oil from smothering and coating of benthic resources and ingestion by animals that feed on benthic resources and demersal fishes in the affected area. Contact with oil or ingestion of oil or oiled prey may have acute or chronic effects on these organisms, including physical effects (such as smothering) and toxicological effects. Additionally, the presence of discharged oil in the environment may have caused decreased habitat utilization of the area, altered migration patterns, altered food availability, and disrupted life cycles. Natural resource services that may have been affected by the oil discharge include, but are not limited to, chemical exchange across the interface between the sea floor and the water column, decomposition and use of organic matter by benthic microalgae and other fauna, primary production, and habitat utilization by benthic and demersal fauna.
>> Response and NRDA data collection efforts were focused on the seafloor and its associated resources and services because these areas had the longest exposure to the submerged oil and a direct pathway for injury (i.e., smothering and coating of benthic resources and ingestion by animals that feed on benthic resources and demersal fishes). A considerable effort was undertaken to assess the nature and extent of oil on the seafloor including its distribution, thickness, fate and transport, and chemical properties. These data were used to estimate injuries to natural resources and services from this incident.
>> Dispersed and dissolved polycyclic aromatic hydrocarbons (PAHs) were detected in the water column, which could have resulted in exposure of aquatic resources to the toxicological effects of PAHs. Various fishes were observed by divers and the ROV in oiled areas, but oiled fishes were not observed or recovered in the submerged oil field. Other ecosystem resources and services in the water column also may have been affected by the discharge, but NOAA declined to investigate those potential injury categories further because NOAA determined the potential effects to animals in most of the water column were likely short-term and of low-magnitude. Detrimental physical and toxicological effects had a low likelihood of occurring based on the

ability of these animals to avoid areas of the water column with oil (e.g., marine mammals). Furthermore, no oiled animals were collected or observed on the ocean surface or water column, indicating that such injuries were unlikely to have occurred or were minimal.
No reports of lost human use were recorded. No ongoing industrial activity was affected. No recreational or commercial fishing vessels were observed in the vicinity of the spill."

From Lake Barre EA:

Aquatic Fauna Injury Assessment
Aquatic fauna, including blue crabs, squid, and shrimp, and different species of fish were affected by the discharge of oil. Water samples collected close to the time of the spill indicated that polycyclic aromatic hydrocarbons (PAHs) were present in the water column for a few days at levels known to be toxic to aquatic organisms in laboratory tests. As evidence of the oil's impact, dead shrimp were collected in a Louisiana Department of Wildlife and Fisheries' trawl and dead juvenile crabs were found in a crab pot. A few dead forage fish were observed shortly after the spill.
The trustees employed a site-specific modeling approach to assess the aquatic fauna impacts. The employed model includes algorithms from the "Natural Resource Damage Assessment Model for Coastal and Marine Habitats" (version 2.4, 1996) and new algorithms and data to account for habitats and fauna specific to the Lake Barre incident. The model estimates the aquatic injury that resulted from death due to exposure to concentrations of low-molecular-weight PAHs in the water column. The model also estimates the resulting loss in growth of the organisms predicted to have died from exposure to PAHs. Based on the model, approximately 7465 kg of fish, decapods, and other invertebrates were lost—due to direct mortality and lost growth—as a result of the discharge. The mortality number does not account for a reduction in aquatic faunal production that resulted from a reduction in marsh service flows supporting aquatic fauna; thus, there is no double counting of the aquatic faunal injuries.

Please advise if you need more.

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: April 29, 2010 9:46:40 AM EDT
To: Daniel Hahn <Daniel.Hahn@noaa.gov>
Cc: Troy Baker <Troy.Baker@noaa.gov>
Subject: Re: SIPPER paragraph

I think as long as the oil slick is not running through the device and its just dispersed particles that will be okay.

I supposed we could drag under the slick just not surface in it.
On Apr 29, 2010, at 9:43 AM, Daniel Hahn wrote:

Did he say anything about dragging it through oil and if that would be a problem?
Dan

Tom Moore wrote:

> I spoke with Drew this morning here a quick description of SIPPER attached. He also mentioned that they can differentiate between live and dead organisms in the water column.
>
> Begin forwarded message:
>
> > **From:** Drew Remsen <aremsen@marine.usf.edu>
> > **Date:** April 29, 2010 9:28:21 AM EDT
> > **To:** Tom Moore <Tom.Moore@noaa.gov>
> > **Subject: SIPPER paragraph**
> >
> > How is this?
> > I didn't do a SOW as I'm not sure what you want to do exactly. Once I get in St. Pete, we could have SIPPER ready in less than 24 hours.
> > It's possible we could have shipped to us a petroleum fluorometer that we could interface with SIPPER to get some good 2-D and 3-D maps of the underwater dispersal of some of the oil compounds in the water, especially as they become emulsified and mix with the water.
> > Le me know if this is adequate or if I need to put more specific application of how this would work with the spill.
> > I will need to contact the ship we will use to figure out what kind of cable termination they have on their hydrowire to ensure we can hook up to the cable. It should be one of two types normally and we are prepped for those.
> > Drew
> >
> > --
> > ~~~~~~
> > Andrew Remsen, Ph.D.
> > College of Marine Science
> > University of South Florida
> > 140 7th Avenue South
> > St. Petersburg, Florida 33701
> > [redacted]
> > ~~~~~~
>
> =
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> ---
>
> --
> Tom Moore
> NOAA Restoration Center
> 263 13th Ave South
> St. Petersburg, Florida 33701
>
> 727-551-5716 Office
> [redacted] Cell

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

B6 Privacy Office
B6 Privacy Cell

Begin forwarded message:

From: Pat Montanio <Pat.Montanio@noaa.gov>
Date: April 29, 2010 10:18:59 AM EDT
To: _NMFS HQ HC ALL <NMFS.HQ.HC.ALL@noaa.gov>
Subject: **NOAA, NMFS, OHC and the Deepwater Horizon event**

All,

Below is a note circulated by David Kenendy regarding the Deepwater Horizon event and NOAA's response. Within NMFS, we are supporting this effort in a variety of ways - from regional and science center capabilities to our ongoing partnership under DARRP.

Brian Pawlak has been appointed as the NMFS liaison to NOAA and NOS senior leaderships for spill response information and action. Captain Gallagher and Jenni Wallace are the F points of contact for requests for information. If you receive a tasker or request from outside this chain, please bring them all into the loop. It is very critical that all relevant information be coordinated and consistently delivered within NOAA, and all media communication regarding the spill should be directed to Public Affairs.

Given the magnitude (as well as uncertainty) of this event, it will require considerable redirection of resources across NOAA. This new assignment will, at least initially, require Brian's full attention. Therefore, I have asked Dean Smehil to serve as Acting Deputy for the Office of Habitat Conservation in the interim.

We all hope that this oil spill can be brought under control relatively quickly, but it is very possible that this will require a long term investment on NOAA's part. Many of you will be asked to contribute in different ways - whether directly or indirectly by covering other assignments. I thank you all in advance, as this is a significant issue for NOAA and the environment.

PatM

-------- Original Message --------
Subject: NOS is playing a crucial role in the Deepwater Horizon event
Date: Thu, 29 Apr 2010 05:51:17 -0400
From: David.Kennedy@noaa.gov
To: _NOS All Hands <nosallhands@noaa.gov>

good morning everyone,

The ongoing oil spill resulting from the Deepwater Horizon poses a grave threat to coastal communities and ecosystems in the Gulf region---and to the national economy. The purpose of this message is to inform you about NOS's role in the response to this incident, recognize the remarkable work of our staff, and to provide you an update on the status of the spill and next steps.

First, I want to recognize the exceptional performance of NOS staff responding to the incident. Dozens are working very long hours to continue gathering information about the spill, plan for containment, and prepare for environmental assessment and response. Eighteen staff members from the Office of Response and Restoration are on site at the command center and more than two dozen others are involved off site. After more than 20 years of being involved with response efforts including serving as science coordinator for the Exxon Valdez spill, I know firsthand how seriously our responders take their jobs and how committed they are to supporting sound, timely decision making. My deep appreciation goes out to them for their work. And I know this is only the beginning of this effort.

As you know, last week, there was an explosion that resulted in a massive fire on the Deepwater Horizon, a mobile offshore drilling unit in the Gulf of Mexico about 50 miles offshore of Louisiana. Sadly, eleven people who were on the rig at the time of the explosion are still not accounted for.
After the rig burned for hours, it capsized and sank into the Gulf on April 22. The undersea oil well is leaking oil at an estimated rate of 1,000 barrels a day at a depth of 5,000 feet.

So far, attempts to use remotely operated vehicles to trigger a series of valves to stop the leak have been unsuccessful. Construction has begun on a collection dome that will be deployed to the sea floor to collect and funnel oil as it escapes from the well, a method that has never been tried at this depth before. The first rig to be used for drilling a relief or cut-off well arrived on the scene and several more are planned. A relief well would take several months to complete.

Staff members from the Office of Response and Restoration (ORR) in the Emergency Response Division have been providing scientific support to the U.S. Coast Guard and the Unified Command that is coordinating response operations. This support includes predicting where the oil is going and its effects, identifying resources at risk, and planning response and over flight operations. Yesterday, NOAA's Assessment and Restoration Division (ARD) brought together more than 20 federal and state natural resource trustees to discuss natural resource damage assessment efforts. ARD is evaluating concerns about potential injuries of oil and dispersants to fishes, human use of fisheries, marine mammals, turtles, and sensitive resources.

In addition, the National Weather Service is providing weather forecasts, including marine and aviation. The Office of Oceanic and Atmospheric Research is advising on airborne dispersion modeling and the National Data Buoy Center data is also being used in oil trajectory forecasting. The National Marine Fisheries Service is addressing issues related to marine mammals, sea turtles, and fishery resources. The National Environmental Satellite, Data, and Information Service is providing analysis of the oil spill using experimental methods with satellite imagery. The Office of Marine and Aviation Operations is providing aircraft support for overflights that are being conducted on a near daily basis.

The impact of this spill will be recorded alongside historic events such as the Exxon Valdez oil spill and Hurricanes Katrina and Rita. During those events, NOAA responded to extraordinary adversity with extraordinary achievement. Our response in this case will require the same level of resolve.
Dr. Lubchenco asked me to serve as the lead for NOAA's response to this incident. Over the coming weeks and months, we will be calling on colleagues from across NOAA and within NOS to supplement these efforts. I will keep you and your program directors informed of the expertise and skills needed from NOS.

In the meantime, you can learn more about NOAA's ongoing response through the following resources:
• ORR's Incident News: http://www.incidentnews.gov/incident/8220
• ORR's Emergency Response Information: http://response.restoration.noaa.gov/ (Click on the link in the upper right hand corner of the page)
dmk

Begin forwarded message:

From: Drew Remsen <aremsen@marine.usf.edu>
Date: April 29, 2010 11:06:43 AM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Subject: FYI oil detection sensors on SIPPER

Tom,
I just read UPDATING THE SMART DISPERSANT MONITORING PROTOCOL:Review of Commercial-Off-The-Shelf Instruments,put together by MMS talking about oil dispersant tracking and it turns out we have a Wetlabs CDOM fluorometer that we can put on SIPPER easily. It could possibly assist in determining the efficacy of the dispersant and its distribution at depth.
http://www.mms.gov/tarprojects/598/SMARTCOTSProductsReportFinal.pdf

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~~~~~~
Andrew Remsen, Ph.D.
College of Marine Science
University of South Florida
140 7th Avenue South
St. Petersburg, Florida 33701
[redacted] B6 Privacy
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Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: April 29, 2010 11:19:51 AM EDT

To: "hahn >> Daniel Hahn" <Daniel.Hahn@noaa.gov>
Subject: Fwd: FYI oil detection sensors on SIPPER

Begin forwarded message:

> **From:** Drew Remsen <aremsen@marine.usf.edu>
> **Date:** April 29, 2010 11:06:43 AM EDT
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> --
> ~~~~~~
> Andrew Remsen, Ph.D.
> College of Marine Science
> University of South Florida
> 140 7th Avenue South
> St. Petersburg, Florida 33701
> [redacted]
> ~~~~~~

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

Begin forwarded message:

> **From:** Tom Moore <Tom.Moore@noaa.gov>
> **Date:** April 29, 2010 11:37:13 AM EDT
> **To:** "hahn >> Daniel Hahn" <Daniel.Hahn@noaa.gov>
> **Subject: SIPPER - Call when you have minute...**
>
> I have spoken with Drew a few times today and think that between the ability to do both plantkon/laval work & also have a flourmeter inline we could get some very valuable data.
>
> He was also not worried about dragging ti through dispersed oil or even under a slick. He is looking to see if USF has a vessel that could support the effort. Likely we would do a 7+ day offshore survey looking at both impact and non-impact areas.
>
> They could just contract through IEc.
>
> I am not super confident in all of the other labs being able to provide a consistent dataset
>
> More info here...

http://www.marine.usf.edu/sipper/

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: April 29, 2010 4:15:09 PM EDT
To: Brian Hostetter <Brian.Hostetter@noaa.gov>
Subject: **Fwd: SIPPER paragraph**

Description attached...

More info at...

http://www.marine.usf.edu/sipper/

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Andrew Remsen, Ph.D.
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University of South Florida
140 7th Avenue South
St. Petersburg, Florida 33701
[redacted]
~~~~~~

Begin forwarded message:

From: Drew Remsen <aremsen@marine.usf.edu>
Date: April 29, 2010 9:28:21 AM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Subject: **SIPPER paragraph**

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and 3-D maps of the underwater dispersal of some of the oil compounds in the water, especially as they become emulsified and mix with the water.
Le me know if this is adequate or if I need to put more specific application of how this would work with the spill.
I will need to contact the ship we will use to figure out what kind of cable termination they have on their hydrowire to ensure we can hook up to the cable. It should be one of two types normally and we are prepped for those.
Drew

--
~~~~~~
Andrew Remsen, Ph.D.
College of Marine Science
University of South Florida
140 7th Avenue South
St. Petersburg, Florida 33701
[redacted] B6 Privacy
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SIPPER descri...doc (272 KB)

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] B6 Privacy Cell

Begin forwarded message:

From: Eric Schwaab <Eric.Schwaab@noaa.gov>
Date: April 29, 2010 6:30:36 PM EDT
To: _NMFS All Employees <NMFS.All.Employees@noaa.gov>
Subject: **Oil Spill Update**

We are all watching with concern the unfolding oil spill incident occurring in the Gulf of Mexico. I wanted to let you know the activities to-date and the critical role that all NOAA line offices are playing, and the process we've established to ensure consistent and up-to-date communications.

As you know, on April 20th, there was an explosion that resulted in a massive fire on the Deepwater Horizon, a mobile offshore drilling unit in the Gulf of Mexico 50 miles offshore Louisiana. The rig burned for hours and then sank. Eleven out of 126 people remain unaccounted for. It was recently discovered that there are multiple leaks at a depth of 5,000 feet.

So far, attempts to use remotely operated vehicles to close valves and stop the leaks have been unsuccessful. Construction has begun on a collection dome that will be deployed to the sea floor to collect and funnel oil as it escapes, a method never tried at this depth before. The first rig to be used for drilling a relief or cut-off well has arrived and more are planned. A relief well would take several months to complete.

I want to acknowledge the tremendous amount of work being accomplished by our leadership and staff in the Southeast Region, Southeast Fisheries Science Center and within Headquarters. Dozens of your colleagues are working long hours, gathering and processing information, anticipating and planning for needed baseline information, on-going monitoring, and long-term response to both marine life and the coastal communities that will be impacted when this spill begins to come ashore.

All parts of NOAA are fully engaged providing scientific support to the U.S. Coast Guard and the Unified Command that is coordinating response operations. The overall coordination for the oil spill within NOAA is through the National Ocean Service

and its Office of Response and Restoration. Support from National Marine Fisheries Service includes addressing impact and response issues related to marine mammals, sea turtles, shrimp and fisheries. National Weather Service is providing marine and aviation forecasts. The Office of Oceanic and Atmospheric Research is advising on airborne dispersion modeling and the National Data Buoy Center data is being used in oil trajectory forecasting. The National Environmental Satellite, Data, and Information Service is providing analysis of the oil spill using experimental methods with satellite imagery. Yesterday, NOAA's Assessment and Restoration Division (ARD) brought together more than 20 federal and state natural resource trustees to discuss natural resource assessments. Through ARD, Fisheries is helping to evaluate concerns about potential injuries of oil and dispersants to fishes, human use of fisheries, marine mammals, turtles and sensitive resources.

Yesterday, Roy Crabtree (Southeast Regional Administrator) and I were in New Orleans and met with the five Gulf States Fisheries Directors and the Gulf States Marine Fisheries Commission. We discussed potential impacts and set up our communication protocol.

Communication Guidance
NOAA and each of its line offices have established oil spill response teams to support the larger Unified Command effort and its Joint Information Center (JIC), as well as the Incident Command Center (ICC). Brian Pawlak (Deputy, Office of Habitat Conservation) is our Oil Spill Coordinator. Two of the most critical roles of this process are to ensure efficient use of our staff resources and provide consistent and accurate information.

To accomplish this, all oil spill "taskers" to Fisheries must be directed through the NOAA ICC. The ICC exists to track taskers, prioritize and deconflict multiple requests for resources, etc. Deputy Under Secretary Mary Glackin has asked everyone to use the ICC for all oil spill taskings. The NMFS desk at the ICC can be reached by email at icc.nmfs@noaa.gov. The telephone number at the ICC is [redacted]. Should you receive any oil spill taskers from anyone else, please forward them to icc.nmfs@noaa.gov for further guidance.

Understandably, we are receiving a great deal of inquiries and expressions of concern from our stakeholders in the Gulf and around the country about the anticipated harm to marine life and the economic impacts. To facilitate consistent and factual information, all press inquiries to Fisheries are to be routed to Connie Barclay (Connie.Barclay@nooa.gov) or Kim Amendola (Kim.Amendola@noaa.gov).

For all other public inquiries, please guide them to the informational web pages that are being updated daily with information on the spill and NOAA's ongoing response (links below), or direct them to Laurel Bryant for further guidance (Laurel.Bryant@noaa.gov)

http://response.restoration.noaa.gov/deepwaterhorizon
http://www.incidentnews.gov/incident/8220

I appreciate everyone's patience and team support during this critical time. Throughout the months ahead, many of you will be called upon to contribute and assist with this effort. Thanks.

Eric C. Schwaab

Eric_Schwaab.vcf (0.2 KB)
Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: April 30, 2010 12:20:27 PM EDT
To: Kristopher Benson <Kristopher.Benson@noaa.gov>
Subject: Fwd: SIPPER paragraph

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: April 29, 2010 4:15:09 PM EDT
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Description attached...

More info at...

http://www.marine.usf.edu/sipper/

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Tom Moore
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[redacted] Office
B6 Privacy Cell

Tom Moore
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263 13th Ave South
St. Petersburg, Florida 33701

[redacted] Office
B6 Privacy Cell

Begin forwarded message:

From: Eugene Shinn <eshinn@marine.usf.edu>
Date: April 30, 2010 1:03:49 PM EDT
To: coral-list@coral.aoml.noaa.gov
Subject: [Coral-List] Disaster in the Gulf and Coral Reefs

With the developing oil disaster in the Gulf, I thought a few comments regarding the effects of crude oil on coral reefs might be healthful. Some of you know my background in the industry and my work with API committees before 1974. In 1972, I was sent to Australia to testify before the Great Barrier Reef Commission regarding effects of drilling on coral reefs. I was concerned, so in preparation for the trip I obtained 5 gallons of Louisiana sweet crude (the kind presently blowing out off the Mississippi Delta) and traveled to the Florida Keys to do some personal in-situ experimenting. Corals on the Barrier Reef flats (including various species of staghorn coral) are exposed to the air at low tide each day for more than one hour. Since that is the length of time that corals there are likely to be exposed directly to floating oil, I performed some crude experiments wherein I exposed Florida staghorn and star coral directly to oil for 1_ hours. In these experiments, I placed large clear plastic bags containing crude oil over live staghorn that was fixed to rods driven into the bottom. At the same time, I placed plastic domes (skylights) containing oil over the tops of small star coral heads for the same length of time. The experiment was conducted in about 15 ft of water off Tavernier Key. What I found, and described pictorially in the 1989 issue of Sea Frontiers, was truly surprising. Corals retracted their polyps, but the oil would not stick to the coral because of its mucus. When I removed the oil, there was no oil on the coral. Fifteen days later, the corals were alive and appeared normal. While at the hearings in Australia, I learned that another researcher wearing a backpack garden sprayer had sprayed crude oil on the same exposed corals at low tide every day for several days. His results were similar to mine.

After joining the USGS, a Master's candidate approached me to do similar experiments for a thesis project. In the laboratory at Fisher Island Station, we totally submerged 10 fragments of living Acropora cervicornis in Louisiana crude for 2 hours. We then transported the fragments (in sea water) to the reef line off Virginia Key, Florida,

and placed them in concrete holders in 20 ft of water. When we returned a week later, the corals were alive and appeared healthy. The disappointed student decided not to continue that project.

In yet another experiment, students of Tom Bright from Texas A&M University conducted an oil experiment on Carysfort Reef lighthouse off Key Largo. A 20-gallon aquarium was filled with aerated seawater. The aquarium contained two butterfly fish and some live A. cervicornis branches. A layer of crude oil about one inch thick was then floated over the coral and fish. Butterfly fish are known to feed on live polyps, so the purpose of the experiment was to see if various fractions of the oil would contaminate the coral and then be transferred to the flesh of the fish. The fish did pick at the coral and paid no attention to the overlying layer of crude oil. After 24 hours, the fish were sacrificed and taken back to Texas A&M to be analyzed for oil components. I never heard the results and nothing was published. I simply documented it all on 16-mm movie film.

The lesson from this and other research was that if and when the oil from this spill reaches the Florida Keys, the damage would be limited mainly to mangrove-shoreline habitats, sea birds, and beaches. Dive-boat operations would likely be affected, but the spill will not harm corals or reef fish. The crude, which will likely be in the form of tar balls, will simply float over the areas of live corals.

Under no circumstances should dispersants be used on an oil slick in the vicinity of a coral reef. Dispersants soluabilize the oil and allow it dissolve in the water and come in direct contact with coral and fish. In addition, oil-containment booms should not be deployed in the vicinity of coral reefs because of possible entanglement and physical destruction. The history of oil spills is that clean-up efforts, such as use of live steam, solvents, and digging, often do more damage than the oil.

The best teacher is history. The Keys and the U.S. East Coast were often awash in oil from torpedoed tankers during WWII, and there have been numerous tanker spills and oil from bilge cleaning over the past 50 years with no documented impact to Florida's coral reefs. An exception is the disastrous onshore oil tank spill at Goleta Point, Panama, in the early 1980s. The spill was at the landward end of a lagoon that opened out to a coral reef being studied by personnel at the adjacent Smithsonian Institution Marine Laboratory. Unfortunately, surfactants were added to break up and soluabilize the oil in an enclosed area with poor circulation with disastrous results. Many reef-flat organisms and corals were killed. Richard Dodge conducted extensive research on the effects of that spill, which are well documented.

In the present case, by the time the spilled oil reaches the Florida Keys (weeks), the more toxic aromatics components will have evaporated, and bacterial breakdown will have reduced the oil to a less toxic gooey mess that can foul beaches, mangroves, and affect sea birds. It will not harm corals or reef fish. Nevertheless, expect to see headlines stating, "Spill Threatens Coral Reefs," and similar overblown claims. Be prepared for one heck of a mess at the shoreline before this is all over. Let's hope it's over soon. Gene

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No Rocks, No Water, No Ecosystem (EAS)

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E. A. Shinn, Courtesy Professor
University of South Florida

Marine Science Center (room 204)
140 Seventh Avenue South
St. Petersburg, FL 33701
<eshinn@marine.usf.edu>
Tel 727 553-1158----------------------------------

Begin forwarded message:

From: Eugene Shinn <eshinn@marine.usf.edu>
Date: May 2, 2010 11:39:07 AM EDT
To: coral-list@coral.aoml.noaa.gov
Subject: **[Coral-List] coral and crude oil**

Dear listers here is some information re the effects of crude oil on coral that may be of use at this crucial time.

With the developing oil disaster in the Gulf I thought a few comments regarding the effects of crude oil on coral reefs might be healthful. Some of you know my background in the industry and work with API committees before 1974. In 1972 I was sent to Australia to testify before the Great Barrier Reef Commission regarding effects of drilling on coral reefs. I was concerned so in preparation for the trip I obtained 5 gallons of Louisiana sweet crude (the kind presently blowing out off the Mississippi Delta) and traveled to the Keys to do some personal in-situ experimenting. Corals on the Barrier reef flats (including various species of staghorn coral) are exposed to the air at low tide each day for more than one hour. Since that is the length of time that corals there are likely to be exposed directly to floating oil I performed some crude experiments where I exposed Florida staghorn and star coral directly to oil for one and a half hours. In these experiments I placed large clear plastic bags containing crude oil over live staghorn that was fixed to rods driven into the bottom. At the same time I placed plastic domes (skylights) containing oil over the tops of small star coral heads for the same length of time. The experiment was conducted in about 15 ft of water off Tavernier Key. What I found, and described pictorially in the 1989 issue of Sea Frontiers, was truly surprising. Corals retracted their polyps but the oil would not stick to the coral because of its mucus. When I removed the oil there was no oil on the coral. Fifteen days later the corals were living and appeared normal. While at the hearings in Australia I learned that another researcher wearing a backpack garden sprayer had sprayed crude oil on the same exposed corals at low tide every day for several days. His results were similar to mine.

After joining the USGS a Masters candidate approached me to do similar experiments for a thesis project. In the laboratory at Fisher Island Station we totally submerged ten fragments of living Acropora cervicornis in Louisiana crude for 2 hrs. We then transported them (in sea water) to the reef line off Virginia Key, Florida and placed them in concrete holders in 20 ft of water. When we returned a week later the corals were alive and appeared healthy. The disappointed student decided not to continue that project.

In yet another experiment students of Tom Bright from Texas A and M University conducted an oil experiment on Carysfort reef lighthouse off Key Largo. A 20-gallon aquarium was filled with aerated seawater. The aquarium contained two butterfly fish and some live A. cervicornis branches. A layer of crude oil about one inch thick was then floated over the coral and fish. Butterfly fish are known to feed on live polyps so the purpose of the experiment was to

see if various fractions of the oil would contaminate the coral and then be transferred to the flesh of the fish. The fish did pick at the coral and paid not attention to the overlying layer of crude oil. After 24 hrs the fish was sacrificed and taken back to Texas A and M to be analyzed for oil components. I never heard the results and nothing was published. I simply documented it all on 16 mm movie film.

The lesson from this and other research was that if and when the oil from this spill reaches the Florida Keys the damage will be to limited mainly to mangrove shoreline habitats, sea birds, and beaches. Dive boat operations will likely be affected but it will not harm corals or reef fish.

The crude, which will likely be in the form of tar balls, will simply float over the areas of living corals. Under no circumstances should dispersants be used on an oil slick in the vicinity of a coral reef. Dispersants soluabilize the oil and allow it dissolve in the water and come in direct contact with coral and fish. In addition, oil containment booms should not be deployed in the vicinity of coral reefs because of possible entanglement and physical destruction. The history of oil spills is that clean up efforts, such as use of live steam, solvents, and digging, often do more damage than the oil.

The best teacher is history. The Keys and the east coast of the US were often awash in oil from torpedoed tankers during WWII and there have been numerous tanker spills and oil from bilge cleaning over the past 50 years with no documented impact to Florida's coral reefs. An exception is the disastrous onshore oil tank spill at Goleta Point, Panama in the early 1980s. The spill was at the landward end of a lagoon that opened out to a coral reef being studied by personnel at the adjacent Smithsonian Institution Marine Laboratory. Unfortunately surfactants were added to break up and soluabilize the oil in an enclosed area with poor circulation with disastrous results. Many reef flat organisms and corals were killed. Richard Dodge conducted extensive research on the effects of that spill which is well documented.

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No Rocks, No Water, No Ecosystem (EAS)
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E. A. Shinn, Courtesy Professor
University of South Florida
Marine Science Center (room 204)
140 Seventh Avenue South
St. Petersburg, FL 33701
<eshinn@marine.usf.edu>
Tel 727 553-1158---------------------------------

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hard so please consider this message as a gentle reminder to not let email be the primary form of communication and that there are a lot of bases to cover. I'll work to stay more engaged by phone with the TWGs but understand that this is tough with 6-8 TWGs and other individuals and groups to keep track of. As of yesterday, Kevin Kirsch is coming in to help me coordinate with multiple teams in multiple locations.

I'm working with IEc to handle all of our contracting needs. Tom Brosnan also will be working with IEc this week to help with our expansion in the Gulf so if you touch base with either Tom or I on contracting, we'll make sure and keep each other in the loop. thanks for all the hard work out there and I'll try and get out of the way again as quick as possible. Troy

Tom Moore wrote:

> All,
> Attached is the initial draft SEAMAP/SIPPER cruise strategy develop by the folks the USF and Florida FWC/FWRI. This should be viewed as just a starting point as all of the PI's are happy to work with us to tweak and change the plans to meet our NRDA injury assessment needs.
>
> We'll have everyone on the phone tomorrow (Sunday) at 12CDT/1EST and we can then have discussion to refine the plan and priorities further. After that if we decide to move forward we'll work with the team to develop a formal cruise plan, QA/QC plan, and data/sampling handling plan, along with other details.
>
> Conference #
>
> 1-[redacted]
>
> Thanks
> Tom
>
> I am available on my cell at [redacted] for any questions.
>
> --

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Troy Baker, SE Branch Chief (Acting)
NOAA National Ocean Service
Office of Response & Restoration / Assessment & Restoration Division
LSU Sea Grant Building, Room 124B
Baton Rouge, LA 70803
(cell) [redacted]
(office) [redacted]
(fax) [redacted]

Begin forwarded message:

From: Todd Barber <[redacted]
Date: May 2, 2010 5:29:40 PM EDT
To: Eugene Shinn <eshinn@marine.usf.edu>
Cc: coral-list@coral.aoml.noaa.gov
Subject: **Re: [Coral-List] coral and crude oil**

Hi Eugene,

The oil on it's way to your coast is not "light sweet crude" like most other oil from the Gulf of Mexico. . While most of the oil drilled off Louisiana is a lighter crude, this isn't. It's a heavier blend because

it comes from deep under the ocean surface. It also emulsifies easily (mixes with water) which it is doing as it is coming up from 5000 feet deep.

Thanks,

Todd R Barber
Chairman, Reef Ball Foundation
3305 Edwards Court
Greenville, NC 27858
[redacted] (Direct)
[redacted] (Cell & Goggle Voice)
toddbarber Skype

www,reefball.org (Reef Ball Foundation)
www.artificialreefs.com (Designed Artificial Reefs)
www.reefbeach.com (Reefs for Beach Erosion)
www.eternalreefs.com (Memorial Reefs)
www.reefball.com (Reef Ball Foundation)

On Sun, May 2, 2010 at 11:39 AM, Eugene Shinn <eshinn@marine.usf.edu> wrote:

> Dear listers here is some information re the effects of crude oil on coral that may be of use at this crucial time.
> With the developing oil disaster in the Gulf I thought a few comments regarding the effects of crude oil on coral reefs might be healthful. Some of you know my background in the industry and work with API committees before 1974. In 1972 I was sent to Australia to testify before the Great Barrier Reef Commission regarding effects of drilling on coral reefs. I was concerned so in preparation for the trip I obtained 5 gallons of Louisiana sweet crude (the kind presently blowing out off the Mississippi Delta) and traveled to the Keys to do some personal in-situ experimenting. Corals on the Barrier reef flats (including various species of staghorn coral) are exposed to the air at low tide each day for more than one hour. Since that is the length of time that corals there are likely to be exposed directly to floating oil I performed some crude experiments where I exposed Florida staghorn and star coral directly to oil for one and a half hours. In these experiments I placed large clear plastic bags containing crude oil over live staghorn that was fixed to rods driven into the bottom. At the same time I placed plastic domes (skylights) containing oil over the tops of small star coral heads for the same length of time. The experiment was conducted in about 15 ft of water off Tavernier Key. What I found, and described pictorially in the 1989 issue of Sea Frontiers, was truly surprising. Corals retracted their polyps but the oil would not stick to the coral because of its mucus. When I removed the oil there was no oil on the coral. Fifteen days later the corals were living and appeared normal. While at the hearings in Australia I learned that another researcher wearing a backpack garden sprayer had sprayed crude oil on the same exposed corals at low tide every day for several days. His results were similar to mine.
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No Rocks, No Water, No Ecosystem (EAS)

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E. A. Shinn, Courtesy Professor
University of South Florida
Marine Science Center (room 204)
140 Seventh Avenue South
St. Petersburg, FL 33701

To: Tom Moore <Tom.Moore@noaa.gov>
Subject: [Fwd: [Fwd: Deepwater Horizon - water sampling and chain of custody]]

-------- Original Message --------
Subject:[Fwd: Deepwater Horizon - water sampling and chain of custody]
Date: Thu, 29 Apr 2010 12:26:45 -0400
From: Daniel Hahn <Daniel.Hahn@noaa.gov>
To: Michel Gielazyn <Michel.Gielazyn@noaa.gov>

My connection was crashed out. so I had to send the original from Jill's computer.
Thanks for following this.
Dan

--
Michel L. Gielazyn, Ph.D.
Regional Resource Coordinator
NOAA - Assessment & Restoration Division
263 13th Avenue South
St. Petersburg, FL 33701

phone: [redacted] B6 Privacy
michel.gielazyn@noaa.gov

2010 0310 ...l.pdf (136 KB)

WaterSampli...OC (32.5 KB)

Begin forwarded message:

From: Kristopher Benson <Kristopher.Benson@noaa.gov>
Date: May 6, 2010 6:42:24 PM EDT
To: "Daniel.Hahn" <Daniel.Hahn@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>
Subject: [Fwd: FW: Protocol for water samples]

FYI, this has the approved safety plan that was used for the water sampling cruise that went out this morning (Dan said he already had this from the FTP site). From what I understand, they started from the vessel's standard safety plan and added the air monitoring component. As I mentioned to Dan when we spoke last, the Weatherbird cruise will not be required to have a certified industrial hygienist on board, but one crew member will be required to man a monitoring instrument for VOCs, and will need to be trained on the instrument. The instrument can be delivered to the vessel when it is in port in Pensacola. Cheryl Metzler is the Health & Safety POC for the instrument and training.

-------- Original Message --------
Subject: FW: Protocol for water samples
Date: Thu, 06 May 2010 15:36:06 -0500
From: Jeffrey Wakefield <JWakefield@entrix.com>
To: kristopher.benson@noaa.gov <Kristopher.Benson@noaa.gov>

**

Jeffrey R. Wakefield, Ph.D.

ENTRIX

/Senior Project Resource Economist/

10 Corporate Circle, Suite 300, New Castle, DE 19720
DIRECT: [redacted] • MAIN: [redacted] • FAX: [redacted]

From: Ralph Markarian
Sent: Thursday, May 06, 2010 10:43 AM
To: Rob Barrick; Kim Sechrist
Cc: John Dimitry; Jeffrey Wakefield; Karen Favret; Ryan Holem
Subject: RE: Protocol for water samples

I am attaching the cruise plan. The third page has a table of the spill/dup plan. The shallower samples will have two sample containers filled underwater at the same time. they cannot be mixed at sea due to contamination so the will stay as dups , not splits based on disc with Jim Payne. the deeper samples will be actual splits since they will be taken in a ten litre sample container with a ROV. Keep this in mind when following guidance provided by Rob below.

* *

*Ralph Markarian**, Ph.D.*

ENTRIX

/Vice President / Technical Director/

10 Corporate Circle, Suite 300, New Castle, DE 19720
DIRECT: [redacted] • MAIN: [redacted] • CELL: [redacted] • FAX: [redacted]

From: Rob Barrick
Sent: Thursday, May 06, 2010 12:15 AM
To: Kim Sechrist
Cc: Ralph Markarian; John Dimitry; Jeffrey Wakefield
Subject: RE: Protocol for water samples

Kim – because of the large bottle size, after collection of the VOA samples it is helpful to swirl (not agitate) the collection bottles between each filling of a sample bottle. That was my guidance between half-filling a sample bottle from a deep-water 5-L bottle but it is appropriate for anything except VOA samples (always collect undisturbed VOAs first). Gentle swirling can't hurt in minimizing oil heterogeneity when we are collecting partial samples from large bottles.

Rob

From: Rob Barrick
Sent: Wednesday, May 05, 2010 9:05 PM
To: Kim Sechrist
Cc: Ralph Markarian; John Dimitry; Jeffrey Wakefield
Subject: Protocol for water samples
Importance: High

Ralph and I spoke about your cruise tomorrow and sampling/analytical requirements. Here is my guidance, some of which is justification for why it is important for a single laboratory, rather than two different laboratories, conduct these analyses:

1. *All samples should be sent only to B&B*. They have done all of our most sophisticated and sensitive analyses to date, including analyses for oil spill modeling at other sites. In addition,

having the same laboratory conduct all analyses on the same sample is important to eliminate uncertainties associated with unknown interlaboratory variability. With these particular samples, the more uncertainty we can eliminate, the better. That need far outweighs any concern over a potential catastrophic loss of a sample, and this potential can be minimized so it is essentially no larger sending both samples to one laboratory versus two laboratories.

2. *Sample shipping*:

– Pack so that bottles for each sampling depth are in different coolers, even if coolers are only partially filled. In that way, if one cooler is lost, only samples for one sampling depth are lost.

– For shipping and analyzing DEEP WATER samples

– Pack the duplicate deep water samples in separate coolers

– Ship both coolers to B&B but on separate days so that if a shipping incident occurs on one day, only one cooler would be affected.

– Request B&B to place the shipments in separate storage units until processed

– Request B&B to process the samples in separate analytical batches so that if an incident occurs at the laboratory, only one sample would be affected. We cannot control whether something happens that causes both samples to be destroyed in separate accidents but not only has that never occurred, I cannot recall when we have ever irreplaceably lost any sample in processing at B&B.

3. *“Shallow” water sample collection*: Ralph and I did not talk about this but if not time-prohibitive (because they are relatively shallow), I would recommend collecting two full sets of duplicate samples and sending the two sets of duplicates in two separate sets of coolers. In other words, at depth A, place duplicate samples into a cooler for shipment and a second set of duplicate samples into a second cooler for shipment. This is essentially the same level of “protection” recommended below for the one set of duplicate deep water samples because they are so costly to collect. If not feasible to collect two sets of duplicates out of an overabundance of caution for the “shallow” samples, then I think it would be OK to settle for just separate shipping of duplicate samples from each depth (with careful packing as usual).

4. *Deep water sample collection*:

– I recommend collecting the deep water sample using a 10-L bottle so that the duplicate samples can be taken as splits from a single bottle. There is little value in an ephemeral “field” duplicate, and in fact, that could lead to more issues than taking a reasonably controlled split sample from one bottle. First collect duplicate VOA samples, then the remaining samples.**

– If a 10-L bottle cannot be used, then collect duplicate samples using two 5-L bottles but in the following procedure that will help obtain ‘homogenized’ samples: First collect both VOA samples from _one_ of the two 5-L bottles (pick either one). This is different than what Ralph and I discussed but will meet objectives better and is a negligible percentage of the total bottle volume. Next, swirl each of the 5-L collection bottle to make sure the contents are mixed (do this _after_ collecting the VOAs). For each of the remaining sample bottles, fill _half_ from each of the two 5-L collection bottles so that each duplicate has 50:50 water from the two 5-L collection bottles. **

As Ralph noted in his e-mail, be sure to take a SAT PHONE with you so we can communicate if needed. Please call anytime with questions about this or anything that I probably have left out.

* *

Thanks!

Rob

Robert C. Barrick

ENTRIX

/Senior Consultant / Senior Associate/

200 First Avenue West, Suite 500, Seattle, WA 98119
DIRECT: B6 Privacy • CELL: B6 Privacy • FAX: B6 Privacy
EMAIL: rbarrick@entrix.com <mailto:rbarrick@entrix.com> • WEBSITE: www.entrix.com <http://www.entrix.com>

ENTRIX, Inc. is a professional environmental and natural resource management consulting company specializing in water resources management, environmental and natural resource liability management (ENRLM), natural resources management and NEPA/state compliance and permitting.

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Please consider the environment before printing this e-mail.

Signed NRD... Sampling.pdf

Kristopher_B...n.vcf (0.3 KB)

Begin forwarded message:

From: DWHNRDA <dwhnrda@gmail.com>
Date: May 7, 2010 6:55:29 PM EDT
To: Alicia.Farrer@noaa.gov, allison.mcleary@dps.la.gov, Amy.Horner@sol.doi.gov, amy.king@dcnr.alabama.gov, Amy.Merten@noaa.gov, Anthony.Dvarskas@noaa.gov, apanian.david@epa.gov, avangeel@indecon.com, Barbara.Schroeder@noaa.gov, barbara_viskup@deq.state.ms.us, barnes@lsu.edu, bbearden@gsa.state.al.us, bdriskell@comcast.net, Benjamin.Shorr@noaa.gov, Benjamin_Simon@ios.doi.gov, benp@ext.msstate.edu, bmink@gsa.state.al.us, bob.mcmichael@myfwc.com, Brad_Segrest@deq.state.ms.us, Branden.S.Blum@noaa.gov, bruce.mcnutt@dep.state.fl.us, Bruce_Peacock@nps.gov, buck.buchanan@dmr.ms.gov, buddy_goatcher@fws.gov, carl.ferraro@dcnr.alabama.gov, Carolyn_Marn@fws.gov, cdonovan@stratusconsulting.com, charles.armbruster@la.gov, charles.killebrew@la.gov, Charles.Kovach@dep.state.fl.us, Cherry_Green@nps.gov, chip_bray@deq.state.ms.us, chris.denson@dcnr.alabama.gov, chris.piehler@la.gov, Christian_Crowley@ios.doi.gov, Christopher.Plaisted@noaa.gov, christopher_reel@nps.gov, CHUCK.MCKINLEY@sol.doi.gov, chuck.sharp@dcnr.alabama.gov, chuck_hunter@fws.gov, clejeune@wlf.la.gov, Craig.R.O'Connor@noaa.gov, cwagner@stratusconsulting.com, D_L_Anderson@nps.gov, Damian_Higgins@fws.gov, Daniel.Hahn@noaa.gov, david.palandro@myfwc.com, david_muth@nps.gov, dchapman@stratusconsulting.com, deborah_rocque@fws.gov, Dena.D.Dickerson@usace.army.mil, dfrenchmccay@asascience.com, diane_beeman@fws.gov, dlavergne@wlf.louisiana.gov, Doug.Helton@noaa.gov, dpeter@wlf.la.gov, dwana.king@la.gov, eenglish@stratusconsulting.com, egraham@asascience.com, ehorsch@stratusconsulting.com, Elaine.Lear@la.gov, elaine_leslie@nps.gov, elkoubi@la.gov, eva_didonato@nps.gov, Frank.Csulak@noaa.gov, fwhitrock@wlf.la.gov, Gareth.Leonard@dep.state.fl.us, Gary.Shigenaka@noaa.gov, George.Graettinger@noaa.gov, Gerald.Mcwhorter@sos.ms.gov, gina.saizan@la.gov, gracie.kennedy@dep.state.fl.us, Greg.Baker@noaa.gov, greg_eckert@nps.gov, Haigler_Pate@nps.gov, HARRIET.DEAL@sol.doi.gov, Hatsue.Bailey@noaa.gov, hblanchet@wlf.la.gov, Heather.J.Theel@usace.army.mil, heather_best@nps.gov, Henry.Norris@MyFWC.com, henry_folmar@deq.state.ms.us, hfinley@wlf.la.gov, irvin.jackson@dmr.ms.gov, james.devitt@la.gov, jan.boyd@dmr.ms.gov, Janet.Whaley@noaa.gov, janet_whitlock@fws.gov, Jay.Field@noaa.gov, jcragan@asascience.com, jeff.jordan@dcnr.alabama.gov, jeff_duncan@nps.gov, jennifer.beall@la.gov, Jennifer.Mouton@la.gov, jennifer.paris@dep.state.fl.us, Jenny.Litz@noaa.gov, jerry.brooks@dep.state.fl.us, Jessica.White@noaa.gov, Jill.Bodnar@noaa.gov, jisaacs@wlf.la.gov, jmichel@researchplanning.com, joe_meiman@nps.gov, John.Foret@noaa.gov, john.mareska@dcnr.alabama.gov, John.R.Wilson@noaa.gov, john_schmerfeld@fws.gov, John_Wullschleger@nps.gov, jon_hemming@fws.gov, Jordan.Stout@noaa.gov, joseph.runnels@dmr.ms.gov, jrowe@asascience.com, Jud.Kenworthy@noaa.gov, karen_battle-sanborn@nps.gov, Karl_Brown@nps.gov, Kate.Clark@noaa.gov,

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Subject: Fwd: [Fwd: [Fwd: Marine Science Review 371: Special Edition - Oil and Oil Spills - Gulf of Mexico]]

Forward from Lisa Dipinto.

This Special Edition of Marine Science Review is a compilation of literature references regarding impacts of oil relevant to the Deep Horizon spill.

-------- Original Message --------
Subject: Marine Science Review 371: Special Edition - Oil and Oil Spills - Gulf of Mexico
Date: Fri, 07 May 2010 12:40:54 -0400 (EDT)
From: SeaWeb <enewsletters@seaweb.org>
Reply-To: enewsletters@seaweb.org
To: John.Cubit@noaa.gov

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Marine Science Review 371: Special edition

Oil and oil spills - the Gulf of Mexico

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In order to support the response efforts to the ongoing oil spill in the Gulf of Mexico SeaWeb has assembled relevant literature from the last three decades which provide insights not only to the impact of oil on the marine and coastal environment in the Gulf of Mexico, but high-lights experiences, issues and research from similar oil spills in other regions of the world. Please let us know if there are relevant papers to add to this list. We will update this review and make it available at: http://www.seaweb.org/resources/msr.php <http://r20.rs6.net/tn.jsp?et=1103373799882&s=1856&e=001yH9_zzOulkeByFFM0y08s-175nrMjeaON48ooDrHh6P1Yyd0L57e3doLahQVAsGfY4QvIITKtGkjJ251NCxoSxh1p0dmVAtt7BFkmGRqrqe0lXDOg6AnShUemrriGlz3TaE6j0H2M4o=>

SeaWeb will produce special editions of the Marine Science Review in response to significant ocean events or issues to ensure that any activities, efforts and media are underpinned by sound science.

In this review:

A. * *Impacts on human health

B. * *Impacts on marine and coastal birds

C. * *Impacts on marine mammals

D. * *Impacts on sea turtles

E. * *Impacts on fish and invertebrates

F. Impacts on coral and coral reefs

G. Impacts on mangroves, salt marshes and seagrasses

H. Previous oil spills

I. Impacts of hydrocarbon production in the Gulf of Mexico

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An evaluation of marine bird population trends following the Exxon Valdez oil spill, Prince William Sound, Alaska.

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Synthesis of effects of oil on marine mammals.

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Oil and sea turtles: Biology, planning, and response.

*

E. Impacts on fish and invertebrates

o

A perspective on the toxicity of petrogenic PAHs to developing fish embryos related to environmental chemistry.

o

Chronic sublethal effects associated with branched

alkylbenzenes bioaccumulated by mussels.

- Toxicity of seawater and sand affected by the Prestige fuel-oil spill using bivalve and sea urchin embryogenesis bioassays.
- Comparative toxicity of oil, dispersant, and oil plus dispersant to several marine species.
- Long-term biological effects of petroleum residues on fiddler crabs in salt marshes.
- Toxic effects of unresolved complex mixtures of aromatic hydrocarbons accumulated by mussels, Mytilus edulis, from contaminated field sites.
- Effects of exposure to petroleum hydrocarbons upon the metabolism of the common sole Solea solea.

* F. Impacts on coral and coral reefs

  - Oil pollution on coral reefs: A review of the state of knowledge and management needs.
  - Oil spills in coral reefs: Planning and response considerations.
  - Short and long term toxicity of crude oil and oil dispersants to two representative coral species.
  - Toxicity of third generation dispersants and dispersed Egyptian crude oil on Red Sea coral larvae.
  - Effects of chronic oil-sediment pollution on the reproduction of the Caribbean reef coral Siderastrea siderea.
  - Short-term ecological consequences of a major oil spill on Panamanian subtidal reef corals.
  -

Injury, regeneration and growth of Caribbean reef corals after a major oil spill in Panama.

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G. Impacts on mangroves, salt marshes and seagrasses

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Oil spills in mangroves: Planning and response considerations.

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Long-term consequences of residual petroleum on salt marsh grass.

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Nonnutrient anthropogenic chemicals in seagrass ecosystems: Fate and effects.

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H. Previous oil spills

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Ecological effects of a major oil spill on Panamanian coastal marine communities.

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The fate of Amoco Cadiz oil.

o

The impact of the "Sea Empress" oil spill.

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The Prestige oil spill and its economic impact on the Galician fishing sector.

o

Estimated costs and admissible claims linked to the Prestige oil spill.

o

Long-term ecosystem response to the Exxon Valdez oil spill.

o

Long-term persistence of oil from the Exxon Valdez spill in two-layer beaches.

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I. Impacts of hydrocarbon production in the Gulf of Mexico

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A review of ecological impacts of oil and gas development on coastal ecosystems in the Mississippi Delta.

o

Evidence of regional subsidence and associated interior wetland loss induced by hydrocarbon production, Gulf Coast region, USA.

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J. Future considerations

o

Trouble on oiled waters: Lessons from the Exxon Valdez oil spill.

o

An international comparison of governmental disclosure of hydrocarbon spills from offshore oil and gas installations.

o Ensuring persistence of marine reserves: Catastrophes require adopting an insurance factor.

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Regional Resource Coordinator, Southwest Region
NOAA Assessment and Restoration Division, Suite 4470 501 W. Ocean Blvd. Long Beach, CA 90802
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Lisa DiPinto, Ph.D. Acting Marine Debris Division Chief
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1305 East West Highway Rm 10218 Silver Spring, MD 20910 phone: 301-713-4248x187 cell: B6 Privacy fax: B6 Privacy
http://marinedebris.noaa.gov

Begin forwarded message:

From: "John.Cubit" <John.Cubit@noaa.gov>
Date: May 7, 2010 7:56:24 PM EDT
To: Greg Baker <Greg.Baker@noaa.gov>, Ann Bailey <abailey@ecochem.net>, Rob Ricker <Rob.Ricker@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Robert Haddad <Robert.Haddad@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>, Troy Baker <Troy.Baker@noaa.gov>
Subject: **Re: [Fwd: Marine Science Review 371: Special Edition - Oil and Oil Spills - Gulf of Mexico]**

Greg,

Regarding your questions on the toxicity of dispersants and dispersant/oil mixtures, here are two fairly recent references regarding impacts of oil and dispersants on coral reefs. The first one reports the results of toxicity bioassays of dispersants and dispersant-oil mixtures on corals and may have references to related toxicological studies. The second is a broader literature review. I have also written coral ecologists working on the Great Barrier Reef to see if they have observed any mortality connected to the spraying of dispersants on the the oil that leaked from the Shen Neng 1 coal carrier that grounded there recently. (I haven't received a reply yet.)

John

Shafir, S., Van Rijn, J., and Rinkevich, B. Short and long term toxicity of crude oil and oil dispersants to two representative coral species. Environmental Science and Technology 41(15): 5571-5574, 2007.
Notes: Oil dispersants, the tool of choice for treating oil spills in tropical marine environments, is potentially harmful to marine life, including reef corals. In a previous study, we found that dispersed oil and oil dispersants are harmful to soft and hard coral species at early life stages. In this broader study, we employed a "nubbin assay" on more than 10 000 coral fragments to evaluate the short- and long-term impacts of dispersed oil fractions (DOFs) from six commercial dispersants, the dispersants and water-soluble-fractions (WSFs) of Egyptian crude oil, on two Indo Pacific branching coral species, Stylophora pistillata and Pocillopora damicornis. Survivorship and growth of nubbins were recorded for up to 50 days following a single, short (24 h) exposure to toxicants in various concentrations. Manufacturer-recommended dispersant concentrations proved to be highly toxic and resulted in mortality for all nubbins. The dispersed oil and the dispersants were significantly more toxic than crude oil WSFs. As corals are particularly susceptible to oil detergents and dispersed oil, the results of these assays rules out the use of any oil dispersant in coral reefs and in their vicinity. The ecotoxicological impacts of the various dispersants on the corals could be rated on a scale from the least to the most harmful agent, as follows: Slickgone > Petrotech > Inipol = Biorieco > Emulgal > Dispolen.

Haapkyla, J., Ramade, F., and Salvat, B. Oil pollution on coral reefs: a review of the state of knowledge and management needs. Vie et Mileau 57(1-2): 95-111, 2007. O/A
Notes: This paper reviews the current state of knowledge of the effects that oil pollution has on scleractinian corals. A review of results obtained in laboratory as well as in field conditions are given and suitable management tools are discussed. Studies made in the 1970s and 1980s presented conflicting results regarding the impacts of oil on coral physiology, but later results confirmed the detrimental effect of oil on corals. The world's coral reefs are severely threatened by an array of factors, one of which is oil pollution. More laboratory and field work with current oils and dispersants is urgently needed in order to update our knowledge in this field and reduce impacts in case of a major oil spill on coral reefs.

Greg Baker wrote:

Thanks John. From a quick glance, there don't appear to be articles about evaluations of oil / dispersant mixtures, one topic that we're scrambling to get our arms around. Is dispersant / oil mixture any more toxic (do dispersants add additional toxic agents to the mix, or do they simply physically change the already present oil constituents?). Do we need to analyze water column samples for additional analytes beyond our normal set? I'm in discussions with Ann Bailey and others on this -

Greg B

John.Cubit wrote:

This Special Edition of Marine Science Review is a compilation of literature references regarding impacts of oil relevant to the Deep Horizon spill.

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Subject: Marine Science Review 371: Special Edition - Oil and Oil Spills - Gulf of Mexico
Date: Fri, 07 May 2010 12:40:54 -0400 (EDT)
From: SeaWeb <enewsletters@seaweb.org>
Reply-To: enewsletters@seaweb.org
To: John.Cubit@noaa.gov

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Ongoing population-level impacts on killer whales Orcinus orca following the 'Exxon Valdez' oil spill in Prince William Sound, Alaska.

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D. Impacts on sea turtles

o

Oil and sea turtles: Biology, planning, and response.

*

E. Impacts on fish and invertebrates

o

A perspective on the toxicity of petrogenic PAHs to developing fish embryos related to environmental chemistry.

o

Chronic sublethal effects associated with branched alkylbenzenes bioaccumulated by mussels.

o

Toxicity of seawater and sand affected by the Prestige fuel-oil spill using bivalve and sea urchin embryogenesis bioassays.

o

Comparative toxicity of oil, dispersant, and oil plus dispersant to several marine species.

o

Long-term biological effects of petroleum residues on fiddler crabs in salt marshes.

o

Toxic effects of unresolved complex mixtures of aromatic hydrocarbons accumulated by mussels, Mytilus edulis, from

contaminated field sites.

o

Effects of exposure to petroleum hydrocarbons upon the metabolism of the common sole Solea solea.

*

F. Impacts on coral and coral reefs

o

Oil pollution on coral reefs: A review of the state of knowledge and management needs.

o

Oil spills in coral reefs: Planning and response considerations.

o

Short and long term toxicity of crude oil and oil dispersants to two representative coral species.

o

Toxicity of third generation dispersants and dispersed Egyptian crude oil on Red Sea coral larvae.

o

Effects of chronic oil-sediment pollution on the reproduction of the Caribbean reef coral Siderastrea siderea.

o

Short-term ecological consequences of a major oil spill on Panamanian subtidal reef corals.

o

Injury, regeneration and growth of Caribbean reef corals after a major oil spill in Panama.

*

G. Impacts on mangroves, salt marshes and seagrasses

o

Oil spills in mangroves: Planning and response considerations.

o

Long-term consequences of residual petroleum on salt marsh grass.

o

Nonnutrient anthropogenic chemicals in seagrass ecosystems: Fate and effects.

*

H. Previous oil spills

o

Ecological effects of a major oil spill on Panamanian coastal marine communities.

o

The fate of Amoco Cadiz oil.

o

The impact of the "Sea Empress" oil spill.

o

The Prestige oil spill and its economic impact on the Galician fishing sector.

o

Estimated costs and admissible claims linked to the Prestige oil spill.

o

Long-term ecosystem response to the Exxon Valdez oil spill.

o

Long-term persistence of oil from the Exxon Valdez spill in two-layer beaches.

*

I. Impacts of hydrocarbon production in the Gulf of Mexico

o

A review of ecological impacts of oil and gas development on coastal ecosystems in the Mississippi Delta.

o

Evidence of regional subsidence and associated interior wetland loss induced by hydrocarbon production, Gulf Coast region, USA.

*

J. Future considerations

o

Trouble on oiled waters: Lessons from the Exxon Valdez oil spill.

o

An international comparison of governmental disclosure of hydrocarbon spills from offshore oil and gas installations.

o Ensuring persistence of marine reserves: Catastrophes require adopting an insurance factor.

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Please click here to download the full edition (pdf) of Marine Science Review 371 <http://r20.rs6.net/tn.jsp?et=1103373799882&s=1856&e=001yH9_zzOulke_z8EMAWw1bKwIVwbC_2Vy4zo0ok_gzmC9GPT0TP5PvtcsP55QBwjjRN1Sk7jfFdV0h1F673uekVXWP1cpm3aGBBgeSdB0wEusdh_e648xz3GQz4HiKq2XNab7as56R3M2O_coW8h_83w_ddU2Zr3CkKU3_BAiprd1f65O5AqNglBx3cz7rCJKvTFgu8wnAwA=>

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Forward this email <http://ui.constantcontact.com/sa/fwtf.jsp?m=1101734456442&a=1103373799882&ea=john.cubit%40noaa.gov>

Forward email <http://ui.constantcontact.com/sa/fwtf.jsp?m=1101734456442&ea=john.cubit%40noaa.gov&a=1103373799882>

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To permanently close your SeaWeb Account, Click Here <http://visitor.constantcontact.com/d.jsp?v=001QlflZB9bhPw-yncAyqfeyt_mhmSwCsgRvUWqOxyAiH6GAv4SZrJyNMuX-C6Gkllz7BKq1QqbFdV4bBYRjNCqZw%3D%3D&p=un> | Privacy Policy <http://ui.constantcontact.com/roving/CCPrivacyPolicy.jsp>

SeaWeb | 8401 Colesville Rd. | Suite 500 | Silver Spring | MD | 20910

--
John Cubit, Ph.D.
Regional Resource Coordinator, Southwest Region
NOAA Assessment and Restoration Division, Suite 4470 501 W. Ocean Blvd. Long Beach, CA 90802 John.Cubit@noaa.gov
tel 562 980-4081 fax 562 980-4084 Cell phone (for urgent matters and travel contact) [redacted]

--
John Cubit, Ph.D.
Regional Resource Coordinator, Southwest Region
NOAA Assessment and Restoration Division, Suite 4470 501 W. Ocean Blvd. Long Beach, CA 90802 John.Cubit@noaa.gov tel 562 980-4081 fax 562 980-4084 Cell phone (for urgent matters and travel contact) [redacted]

Begin forwarded message:

From: Tom Moore <tom.moore@noaa.gov>
Date: May 8, 2010 6:06:06 PM EDT
To: Kara Radabaugh <[redacted]>
Subject: Fwd: Draft SEAMAP/SIPPER Cruise Strategy -

Background on why we are doing the cruise from our modeler... One of Debbie's folks is also on the cruise.

Sent from my iPad

On May 8, 2010, at 10:52 AM, Ernst Peebles <epeebles@marine.usf.edu> wrote:

I just read this - they were on schedule yesterday afternoon but I see they are are behind schedule now (4 stations/day instead of 5-6). Would you consider a touch-and-go for samples followed by a regular port call on Tuesday or Wednesday? The existing crew could stay out there working in the rough weather, and then we could do leg 2 in better conditions. Ernst

X-USFCMS-MailScanner-Watermark: 1273929115.1998@8hxqYc7f7AnjtqIrq9B60A
Date: Sat, 08 May 2010 09:11:54 -0400
From: Randy Maxson <jmaxson@marine.usf.edu>
User-Agent: Thunderbird 2.0.0.24 (Windows/20100228)
To: Tom Moore <Tom.Moore@noaa.gov>
CC: Ernst Peebles <epeebles@marine.usf.edu>,
Maxson Randy FIO <jmaxson@seas.marine.usf.edu>,
"hahn >> Daniel Hahn" <Daniel.Hahn@noaa.gov>,
Kristopher Benson <Kristopher.Benson@noaa.gov>,
"Hogarth, Bill" <bill.hogarth@admin.usf.edu>,
Sandra Vargo <svargo@marine.usf.edu>,
Rob Walker <rwalker@marine.usf.edu>,
"mattheww >> Matthew White" <mattheww@admin.usf.edu>,
vchachere@admin.usf.edu
Subject: Re: HAZOPPER Monday @ 1600
X-USFCMS-MailScanner-Information: Please contact postmaster@marine.usf.edu for more information
X-USFCMS-MailScanner: Not scanned
X-USFCMS-MailScanner-From: jmaxson@marine.usf.edu
X-Spam-Status: No

Tom will have transit time to you shortly. Just spoke with the Captain. They are 48 nm south of Cape San Blas, ops normal. They completed three stations during the past 24 hours (stas 814, 813 & 816). There was some difficulty with a trawl net yesterday that required swapping out a net that ate up a lot of time. They have completed 8 stations in the past 48 hours.

Randy

Tom Moore wrote:

Randy,

That is completely understandable and of course crew and vessel safety is our first priority. If you get a first light departure from Pensacola what is the transit time to 28.51666, -87.19748.
Thanks
Tom

Sent from my iPad

On May 8, 2010, at 7:51 AM, Randy Maxson <jmaxson@marine.usf.edu> wrote:

Ernst / Tom, the port call and HAZWOPPER training is going to be a disruption to the normal watch /sleep rotation for the crew. It will be in the best interest of crew and vessel safety if the ship lays inport overnight and departs first thing Tuesday morning.
Tom Moore wrote:

It turns out getting the HAZWOPPER training arranged was more difficult then expected. After a bit of back and forth I was able to arrange for the course to take place on the WB at 1600. They say it is a 6 hour training but told me it will likly be done in 4.

Thank you very much for everyones flexablity.

Tom

Sent from my wireless...

--
Randy Maxson
Marine Superindendent
The Florida Institute of Oceanography
830 First Street South
St Petersburg, FL. 33701
727-553-1100
[redacted] fax
[redacted] cell
jmaxson@marine.usf.edu
www.marine.usf.edu/FIO

--
Randy Maxson
Marine Superindendent
The Florida Institute of Oceanography
830 First Street South
St Petersburg, FL. 33701
727-553-1100
[redacted] fax
[redacted] cell
jmaxson@marine.usf.edu
www.marine.usf.edu/FIO

____

Ernst Peebles, Ph.D.
USF College of Marine Science
140 Seventh Avenue South
St. Petersburg, FL 33701
office phone: (727) 553-3983
lab phone: [redacted]
fax [redacted]

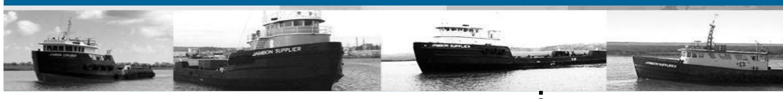
____

--
Daniel Hahn, Ph.D.
Regional Resource Coordinator
National Oceanic and Atmospheric Administration
Assessment & Restoration Division, SE Region
263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: (727) 551-5715
Fax: [redacted]
Cell: [redacted]

M/V Jack Fitz

Official Number 1074297



MAIN PARTICULARS

Length Overall:	165'
Beam:	36'
Depth:	12
Light Draft:	5"10"
Freeboard:	2' 3"
Clear Deck Space:	3090 sq ft 103' x 30'

CAPCATIES

Deck Cargo:	500 Lt
Cargo Water:	81,500 US Gallons
Fuel:	52,800/124,200 US Gallons
Potable Water:	10,000 US Gallons
Lube Oil:	1,300 US Gallons
Dirty Oil:	3,600 US Gallons
Sewage:	3,000 US Gallons
Liquid Mud:	71,400 US Gallons/1,700 bls
Walk In Cooler:	YES

Machinery

Main Engines (2):	Caterpillar 3508 MTU
Horsepower:	1610 hp
Reduction Gears:	Twin Disk MG626
Bow Thruster:	Schottel
Propellers:	4 Bid Brz
Generators (2):	Delco 99 kw 480 Volts
Driven By:	Caterpillar 3304
Fire Monitor:	4' Ekhart
Fuel Consumption:	
GPH @ 12 knots:	67 US Gallons
GPH @ 10 knots:	52 US Gallons
Fuel Pump:	Barnes 10cce

Maximum Discharge 150 gpm @ 80' Head

ACCOMMODATIONS

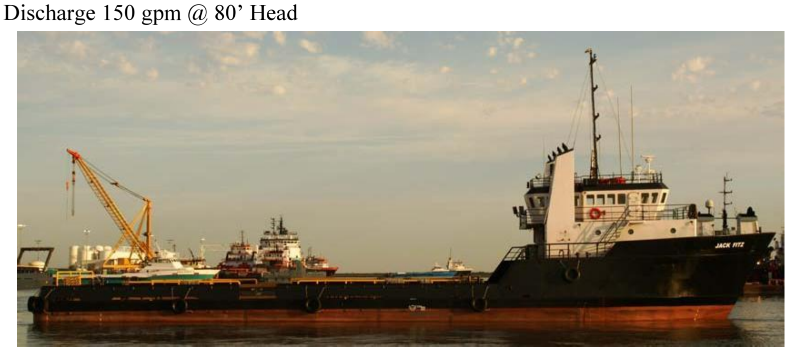
Staterooms: 6
Berths: 20
Galley Seating: 10

ELECTRONICS

DP System: MT DP-1 W/Joystick
Gyro: (2) SG Brown
2 RM Young Wind Tracker & Sensor
Radars (2): Furuno 1932 Mark 2
AIS: Furuno FA100
Radios
VHF (3): Standard Horizon GX1500S
GPS (2): Furuno GP 32
(1): C-Nav 2050
DGPS (1): C-Nav 1000 GNSS Receiver
Navtex: Furuno NX-300
GMDSS: Felcom 15 Inmarsat C
2 FM8800 w/DSC
Fathometer: Datamarine International Offshore
Auto Pilot: Comm Nav 1001
Iridium Sat Phone: 881621416003
[redacted]
International Sat Services, Mitsubishi Sat
Phone: [redacted]
Advanced Logistics SAMM System

REGISTRATION

Flag:	US
Home Port:	Golden Meadow, La
Call Sign:	WCZ2375
Builder:	Master Boat Builders
Year Built:	1999

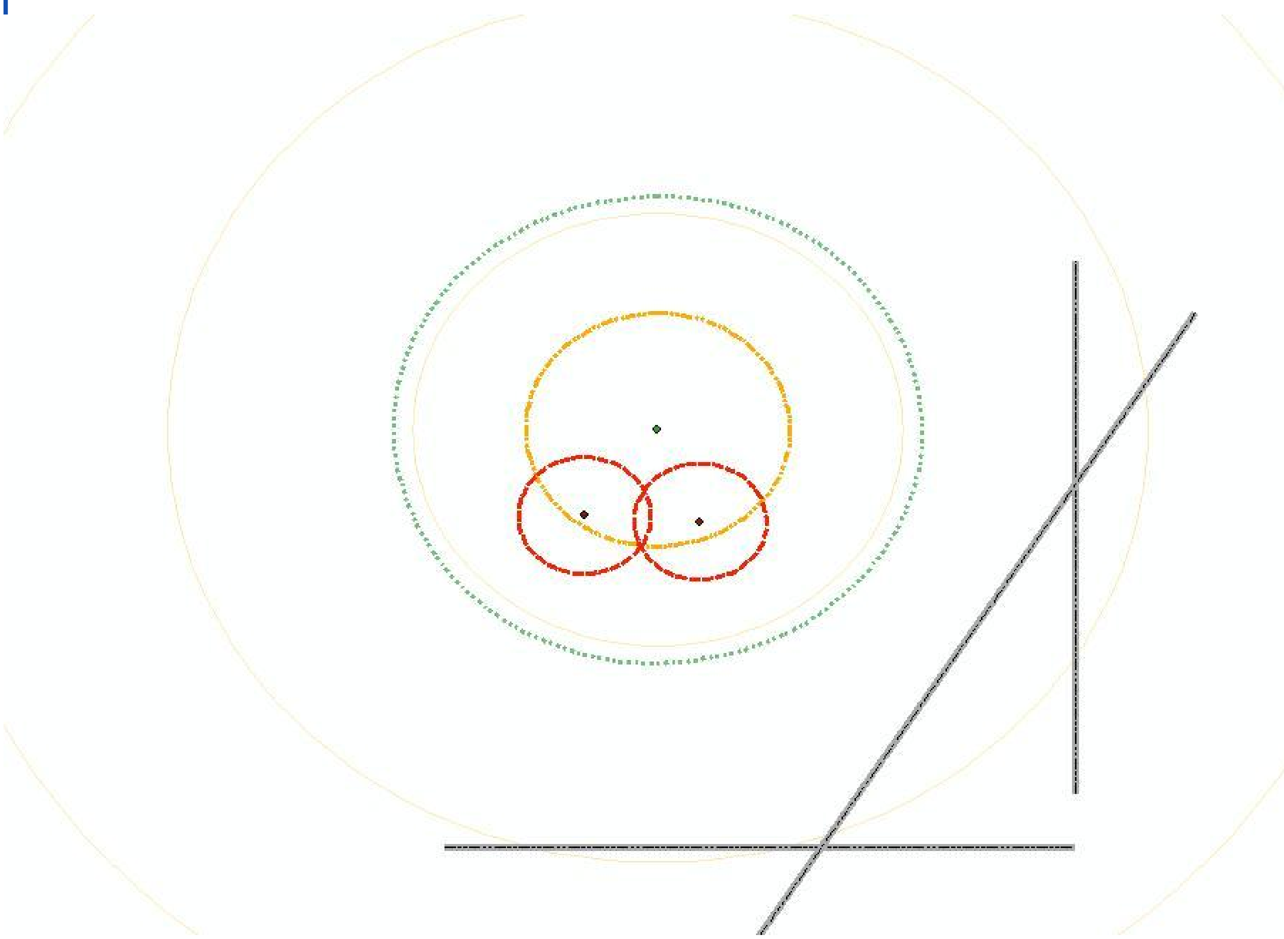


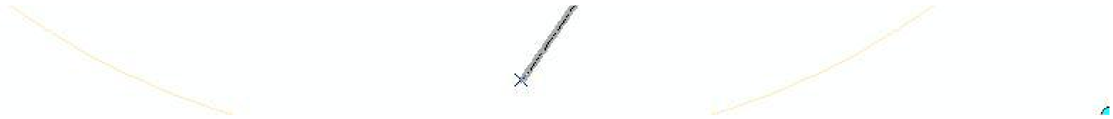
Jack Fitz ABS...pdf (36.3 KB)

M C 252 Inci...pproved.pdf

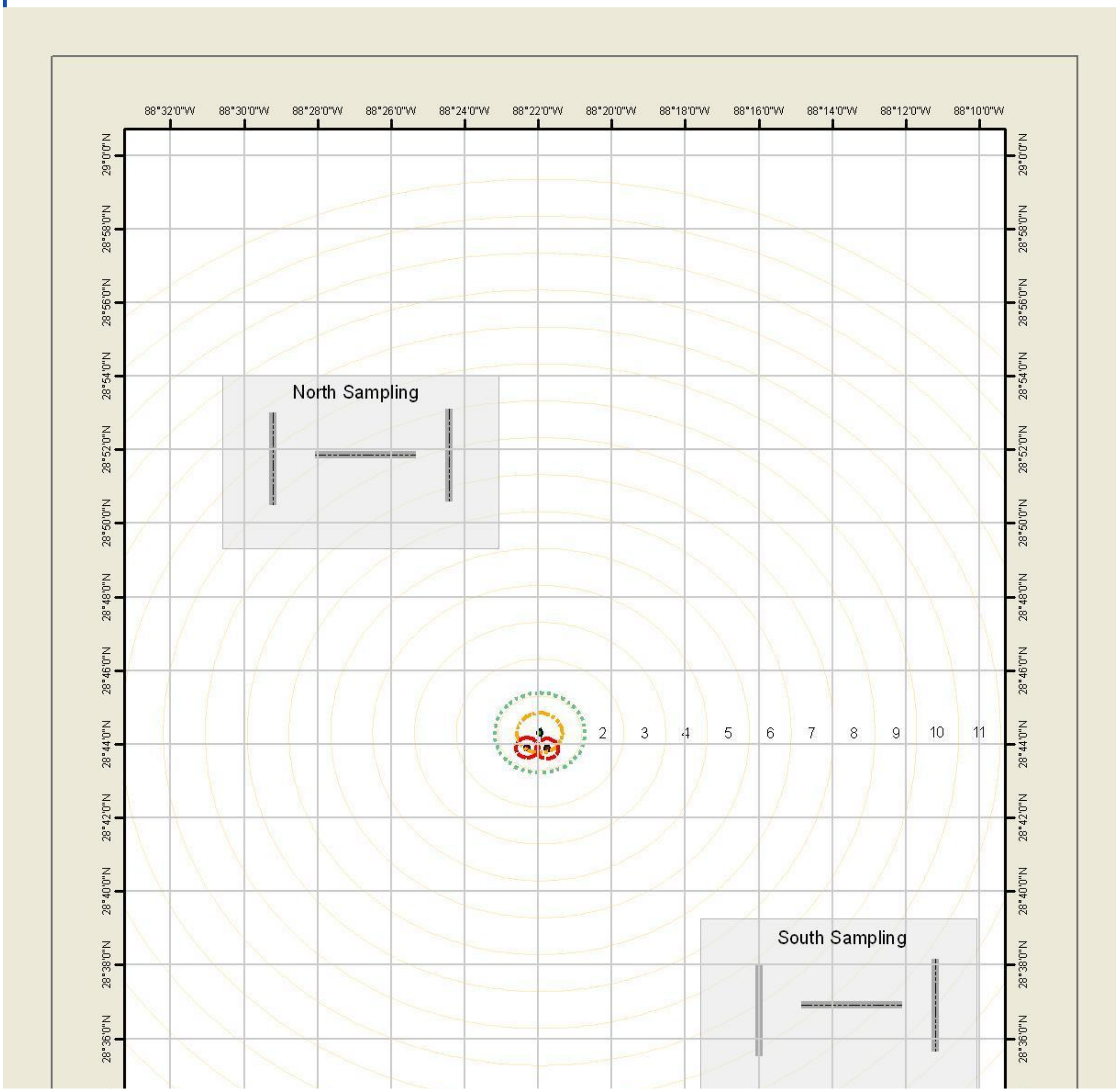
Begin forwarded message:

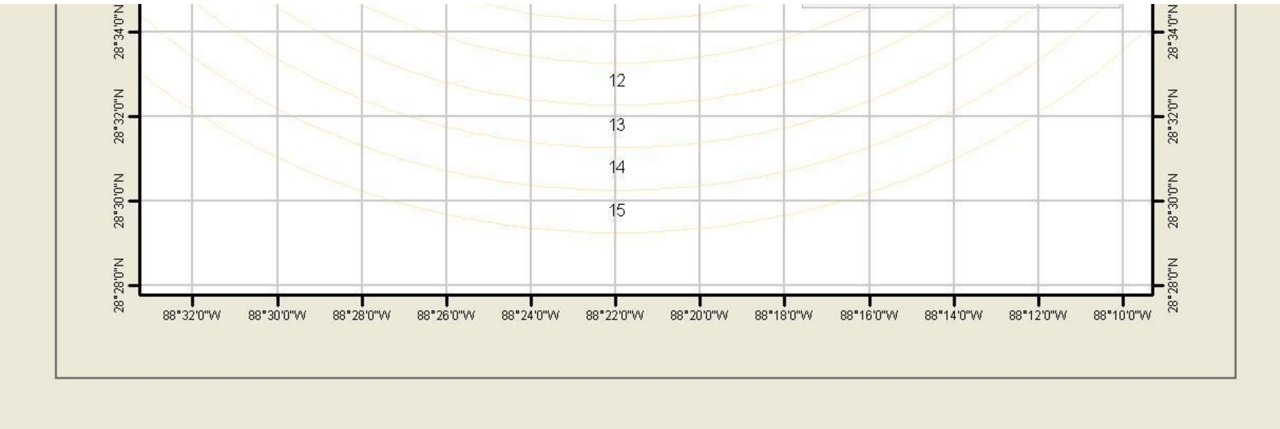
> **From:** Tom Moore <Tom.Moore@noaa.gov>
> **Date:** May 10, 2010 10:43:48 PM EDT
> **To:** Debbie French McCay <DFrenchMcCay@asascience.com>
> **Cc:** "hahn >> Daniel Hahn" <Daniel.Hahn@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>, Andrew Remsen <aremsen@marine.usf.edu>, "David L. Jones" <djones@rsmas.miami.edu>, Melanie Schroeder <mschroeder@asascience.com>
> **Subject: DH - Plume Area SIPPER Transects**
>
> Debbie,
> Since our conversation earlier today I have spoken with the folks who control water access near the site. They are very willing to work with us, but it certainly seems the closer we are to the action the more highly scrutinized are activities will be. They are willing to let us be flexible with planning but I also get the impression that depending on what is going on any given day we may only get one time slot for the plume. Our time around the plume may also conflict with dispersant application so we need to get in and out.
>
> In order to get as much information as possible I was thinking we could request a 4-6 hour time slot (however long SIPPER can stay in with out a battery change), put SIPPER in the water once and try to hit three transects (without taking SIPPER out of the water) downstream of whatever directions the current is pushing the plume. If we try to do the tic/tac/toe pattern it sounds like we will need multiple entry authorizations and likely will need to recover/redeploy SIPPER losing a bunch of time. In this process they should also be able to pull some snapshots and see if we are getting the droplet size info that is needed.
>
> Attached is a graphic of what I was thinking:





For the "D" stations the SIMOPS folks are likely to give us access to a "box" for a period of time (~4-6 Hours). I figured we would setup a North box and South box and then tell the team to sample them as effectively as possible in the given time. SIMOPS will be flexible on the box location as the oil moves, but we likely need to lock in by Thursday at 1800. For purposes of giving BP a graphic I was going to send the following (adjusted from previous based on SE winds and currents to the East). That said they understand the box location and what happens inside of it is fluid and asked just for an example schematic. Below is what I was going to send if you concur.





Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

B6 Privacy Office
B6 Privacy Cell

Begin forwarded message:

From: Debbie French McCay <DFrenchMcCay@asascience.com>
Date: May 11, 2010 12:26:08 AM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Cc: "hahn >> Daniel Hahn" <Daniel.Hahn@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>, Andrew Remsen <aremsen@marine.usf.edu>, "David L. Jones" <djones@rsmas.miami.edu>, Melanie Schroeder <mschroeder@asascience.com>
Subject: **RE: DH - Plume Area SIPPER Transects**

Tom,

Your design and logic make sense to me. When I drew the tic/tack/toe pattern when I had only ADCP data on the currents at the wellhead, and it showed all directions at various depths and times. The ADCP has shown flow to the south since noon May 5. The currents are weak and variable from 1200m up to about 100m down. Above that, the plume is sheared off and directed with the surface layer currents (i.e., those above 100m). The currents above 100m were very low (<0.2 kts) until May 5 about noon CDT. From May 5 at noon CDT until May 10 at 0000CDT, the surface currents were up to 0.8kts directed to the S (until noon May 7) and then to the SE (until May 10 > at 0000CDT). Since this morning (May 10, 000-0700 CDT) they are slower, up to 0.4 kts to the ESE.

Thus, I like your configuration, and sampling the east and south sides for the "P" transects. In addition, the south side "downstream" transects are now the prefered configuration. With the currents directed southward to ESE the last 5 days, it makes sense to focus on, again, the east and south sides. If currents change we can alert them, but it is looking like southward to ESE-directed currents are stablized. To the north of the wellhead, it does not appear that there is any plume surfacing now.

Good night now,
Deb

Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive

South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted]

____

From: Tom Moore [Tom.Moore@noaa.gov]
Sent: Monday, May 10, 2010 10:43 PM
To: Debbie French McCay
Cc: hahn >> Daniel Hahn; Stephanie Willis; Andrew Remsen; David L. Jones; Melanie Schroeder
Subject: DH - Plume Area SIPPER Transects

Debbie,
Since our conversation earlier today I have spoken with the folks who control water access near the site. They are very willing to work with us, but it certainly seems the closer we are to the action the more highly scrutinized are activities will be.   They are willing to let us be flexible with planning but I also get the impression that depending on what is going on any given day we may only get one time slot for the plume. Our time around the plume may also conflict with dispersant application so we need to get in and out.

In order to get as much information as possible I was thinking we could request a 4-6 hour time slot (however long SIPPER can stay in with out a battery change), put SIPPER in the water once and try to hit three transects (without taking SIPPER out of the water) downstream of whatever directions the current is pushing the plume.   If we try to do the tic/tac/toe pattern it sounds like we will need multiple entry authorizations and likely will need to recover/redeploy SIPPER losing a bunch of time. In this process they should also be able to pull some snapshots and see if we are getting the droplet size info that is needed.

Attached is a graphic of what I was thinking:

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 11, 2010 11:40:09 AM EDT
To: Ian J Zelo <ian.j.zelo@noaa.gov>, Lisa Dipinto <Lisa.Dipinto@noaa.gov>, Troy Baker <Troy.Baker@noaa.gov>, Mary Elliott Rolle <MaryElliott.Rolle@noaa.gov>
Cc: Brian Hostetter <Brian.Hostetter@noaa.gov>, "hahn >> Daniel Hahn" <Daniel.Hahn@noaa.gov>
Subject: **DH - Is there a Coral Workgroup?**

Hi All,
I just got a call from Mike Buchman and then separately from Bill Goodwin, both with FKNMS, wanting to know how development of the plan was going for the coral workgroup, apparently they were under the impression I was the group coordinator.

That is fine, but it was news to me.

If we do spin up a coral workgroup were going to need to have two sub-groups. One for Deep Coral in the Northern Gulf and other for Shallow Coral in the Tortuga's and Marquesa's west of Key West. The Deep Coral stuff is likely to be an issue either way, given the proximately of these habitats to spill area. The Shallow Water Reefs will hopefully never be an issue unless we get oil or dispersed oil in the loop current, but we should still make sure were on top of the issue before that happens.

Thanks
Tom

Tom Moore
NOAA/DARRP
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

Begin forwarded message:

From: "Lisa.Dipinto" <Lisa.Dipinto@noaa.gov>

Date: May 11, 2010 12:03:56 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Subject: **Re: DH - Is there a Coral Workgroup?**

I have not heard of and certainly did not suggest you as head of that work group- my recollection was that Buchman was heading that, and that he was going to lead plan development. When last we spoke, I asked him to get me a brief writeup on what he wanted to do regarding baseline sampling (as that was the specific topic) including what, why, where, and how much it wouild cost. Not sure how this miscommunication occurred. Ian (the new NRDA lead as of today) will follow up with Buchman on this issue.
thanks,
Lisa

Tom Moore wrote:

> Hi All,
> I just got a call from Mike Buchman and then separately from Bill Goodwin, both with FKNMS, wanting to know how development of the plan was going for the coral workgroup, apparently they were under the impression I was the group coordinator.
> That is fine, but it was news to me.
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>
> Thanks
> Tom
> --
> Tom Moore
> NOAA/DARRP
> 263 13th Ave South
> St. Petersburg, Florida 33701
>
> [redacted] Office
> Cell

--
Lisa DiPinto, Ph.D. Acting Marine Debris Division Chief
Office of Response and Restoration Marine Debris Division
1305 East West Highway Rm 10218 Silver Spring, MD 20910 phone: [redacted] cell: [redacted] fax: [redacted]
http://marinedebris.noaa.gov

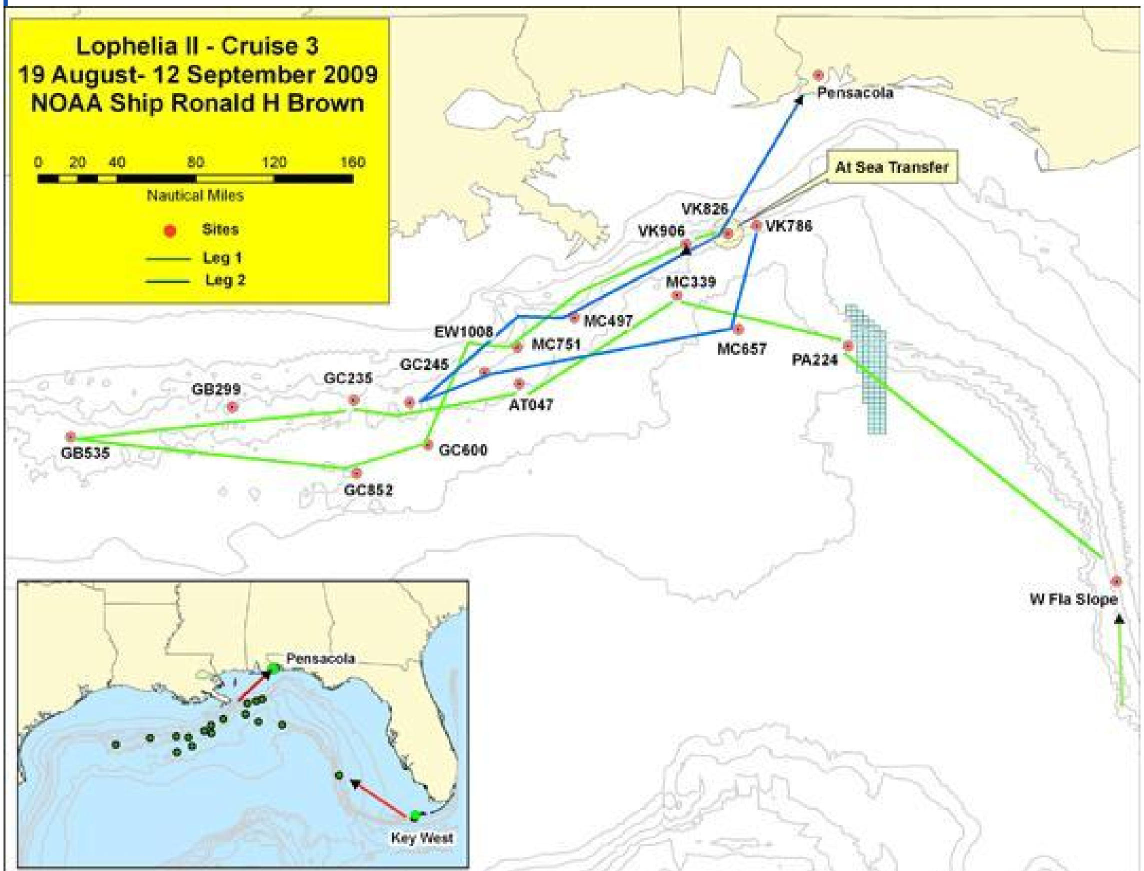
Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 11, 2010 12:11:53 PM EDT
To: "Lisa.Dipinto" <Lisa.Dipinto@noaa.gov>, Ian J Zelo <ian.j.zelo@noaa.gov>
Subject: **Re: DH - Is there a Coral Workgroup?**

I heard separately from M.E. that folks had a desire to keep this in DARRP so maybe that was the deal where this started.

I am happy to do it, though currently I think the focus needs to be the deep corals and not the Keys.

Some of the nicest deep reefs in the Gulf are very close to MC 252. Fortunately NOAA has done quite bit of work in the area and actually did a month long survey in that area less then a year ago. See attached cruise track...



On May 11, 2010, at 12:03 PM, Lisa.Dipinto wrote:

> I have not heard of and certainly did not suggest you as head of that work group- my recollection was that Buchman was heading that, and that he was going to lead plan development. When last we spoke, I asked him to get me a brief writeup on what he wanted to do regarding baseline sampling (as that was the specific topic) including what, why, where, and how much it wouild cost. Not sure how this miscommunication occurred. Ian (the new NRDA lead as of today) will follow up with Buchman on this issue.
> thanks,
> Lisa
>
> Tom Moore wrote:
>
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>>
>> Thanks
>> Tom
>> --

Tom Moore
NOAA/DARRP
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
B6 Privacy Cell

--
Lisa DiPinto, Ph.D. Acting Marine Debris Division Chief
Office of Response and Restoration Marine Debris Division
1305 East West Highway Rm 10218 Silver Spring, MD 20910 phone 301-713-4248x187 cell: B6 Privacy fax: B6 Privacy
[redacted] http://marinedebris.noaa.gov

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
B6 Privacy Cell

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 11, 2010 12:13:20 PM EDT
To: Mary Elliott Rolle <MaryElliott.Rolle@noaa.gov>
Subject: Fwd: DH - Is there a Coral Workgroup?

FYI...

Begin forwarded message:

From: "Lisa.Dipinto" <Lisa.Dipinto@noaa.gov>
Date: May 11, 2010 12:03:56 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Subject: Re: DH - Is there a Coral Workgroup?

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thanks,
Lisa

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coordinator.
That is fine, but it was news to me.
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Thanks
Tom

Tom Moore
NOAA/DARRP
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
B6 Privacy Cell

--
Lisa DiPinto, Ph.D. Acting Marine Debris Division Chief
Office of Response and Restoration Marine Debris Division
1305 East West Highway Rm 10218 Silver Spring, MD 20910 phone: 301-713-4248x187 cell: B6 Privacy fax: B6 Privacy
[redacted] http://marinedebris.noaa.gov

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

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B6 Privacy Cell

Begin forwarded message:

From: Caitlin Lustic <clustic@tnc.org>
Date: May 11, 2010 4:49:16 PM EDT
To: Caitlin Lustic <clustic@tnc.org>, restoration@frrp.org, James Byrne <jbyrne@tnc.org>, Meaghan Johnson <meaghan_johnson@tnc.org>, Chris Bergh <cbergh@tnc.org>, Aaron Hutchins <ahutchins@tnc.org>, Kemit-Amon Lewis <klewis@tnc.org>, Daniel Green <dgreen@tnc.org>, Jonathan Brown <jonathan_brown@tnc.org>, Ron Sjoken <rsjoken@tnc.org>, Jennifer Greene <jgreene@tnc.org>, Robert Brumbaugh <rbrumbaugh@tnc.org>, Amanda Wrona <awrona@tnc.org>
Subject: **Re: [Restoration] Oil spill response call RESCHEDULE**

Hi everyone –

Thanks to those who were able to make the call, and specifically Aaron for fielding our questions. Some of the questions that came up were:

How do we deal with the oil in the nurseries if it is in the form of tar balls or some other form of thick, sinking oil rather than a surface slick?

What will the effects of the dispersants be on the coral?

Is there anything we can do to protect the nursery corals?

Aaron and Kemit will be attending a meeting next week of the Caribbean Regional Response Team, and have offered to take our questions with them to see if they can get any more information. Many of the responders who would normally attend this meeting are likely in the Gulf helping out but it can't hurt to compile a list of questions and see what information we can get. **Please send me your questions by Monday, May 17.**

Some other important information:

Any expenses that you incur on the nursery project as a result of the oil spill (including time, additional equipment, etc.) can be paid under ARRA but should be very carefully documented. Please contact me if you have any questions about this.

James is currently doing some research into OSHA rules and requirements as they relate to diving in the presence of oil. We will get more details out soon, but there will be guidance about when it is safe to dive.

Please be very vigilant in monitoring for now so that we have accurate and recent data about the status of the nursery corals. Good baseline data could prove very important.

We will be in touch again as needed.

Thanks,

Caitlin

From: Caitlin Lustic
Sent: Thursday, May 06, 2010 9:19 AM
To: Caitlin Lustic; 'restoration@frrp.org'; James Byrne; Meaghan Johnson; Chris Bergh; Aaron Hutchins; Kemit-Amon Lewis; Daniel Green; Jonathan Brown; Ron Sjoken; Jennifer Greene; Robert Brumbaugh; Amanda Wrona
Subject: Oil spill response call RESCHEDULE

Since most everyone is going to be out on the water this Friday, let's reschedule for Tuesday at 4pm. Join us if you can.

Call-in number: B6 Privacy

Access code: B6 Privacy

Caitlin Lustic

From: Caitlin Lustic
Sent: Tuesday, May 04, 2010 9:19 AM
To: restoration@frrp.org; James Byrne; Meaghan Johnson; Chris Bergh; Aaron Hutchins; Kemit-Amon Lewis; Daniel Green; Jonathan Brown; Ron Sjoken
Subject: Oil spill response call - Friday 10am

Good morning everyone –

We would like to have a call this Friday at 10am to discuss potential oil spill response plans. I know this is late notice, so join us if you can, and I'll take and distribute meeting minutes for those who cannot. If you are unable to call in but have some thoughts you would like heard, give me a call or send me an email.

Thanks,

Caitlin

Call-in number: [redacted]

Access code: 20288020

Caitlin Lustic
Coral Recovery Coordinator

clustic@tnc.org
[redacted] Ext. 114 (Phone)
(Fax)

nature.org

The Nature Conservancy
Florida Keys
P.O. Box 420237
Summerland Key, FL 33042

Shipping: 55 N. Johnson Rd.

Sugarloaf Key, FL 33042

Begin forwarded message:

From: Debbie French McCay <DFrenchMcCay@asascience.com>
Date: May 12, 2010 12:28:07 AM EDT
To: Daniel Hahn <Daniel.Hahn@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>
Subject: **RE: Today's overflight.**

Tom and Dan,

I am not seeing what you saw about the plume going north. These are notes in an overflight this afternoon?

The Payne cruise is going to sample the rising plume tomorrow am and all indications I can find show that the rising plume extends to the east. The ADCP shows eastward currents in the surface layer (to 100 deg. about 0.7 kts), and the currents 100-300m down are ~0.2 kts to NE. Net seems to be about due east. See vector plot attached. This is at:
http://www.ndbc.noaa.gov/station_page.php?station=42916

Attached is an Ocean Imaging overflight interpretaions from 0900cdt May 10, the most recent we have. At that time yesterday, the eastward plume was 1.5km = 0.8nmile long. This seems to be the untreated oil coming up. The southward plume is unclear, might be from dispersant-injected oil coming up more slowly and being carried south in deeper waters. These features have been present for a few days now.

We'd like the Sipper to sample both these plumes. Ocean Imaging should be up flying again soon (was not today), so we should get more by the 14th.

Deb

Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted]

____
From: Daniel Hahn [Daniel.Hahn@noaa.gov]
Sent: Tuesday, May 11, 2010 9:10 PM
To: Tom Moore
Cc: Debbie French McCay
Subject: Re: Today's overflight.

Agreed that is would be good to have dave relay information back to us
the days leading up to our time in the plume.
Dan

Tom Moore wrote:
> Check out the notes on the afternoon overflight today. Plume is noted as 3nm long but it seems to suggest it is going north of the source...
>
> Maybe we should follow-up with Dave, it would also be good for those guys to know our ops plan for the spill area so they can relay pertinent information.
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> Sent from my iPad

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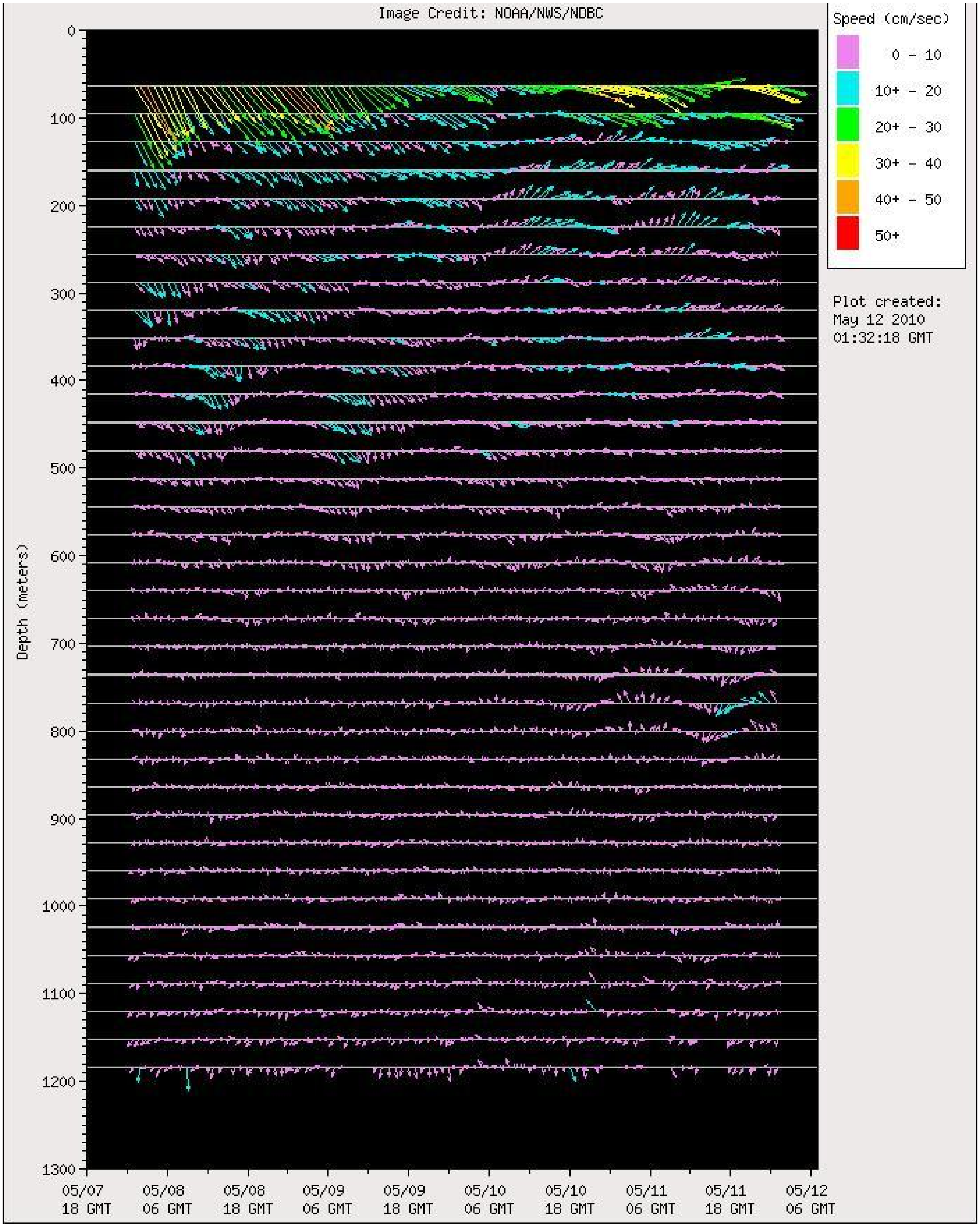
Daniel Hahn, Ph.D.
Regional Resource Coordinator
National Oceanic and Atmospheric Administration
Assessment & Restoration Division, SE Region
263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: (727) 551-5715
Fax: [redacted]
Cell: [redacted]

Classificatio...0900CDT.jpg

Ocean Current Stick Plot for Station 42916



Begin forwarded message:

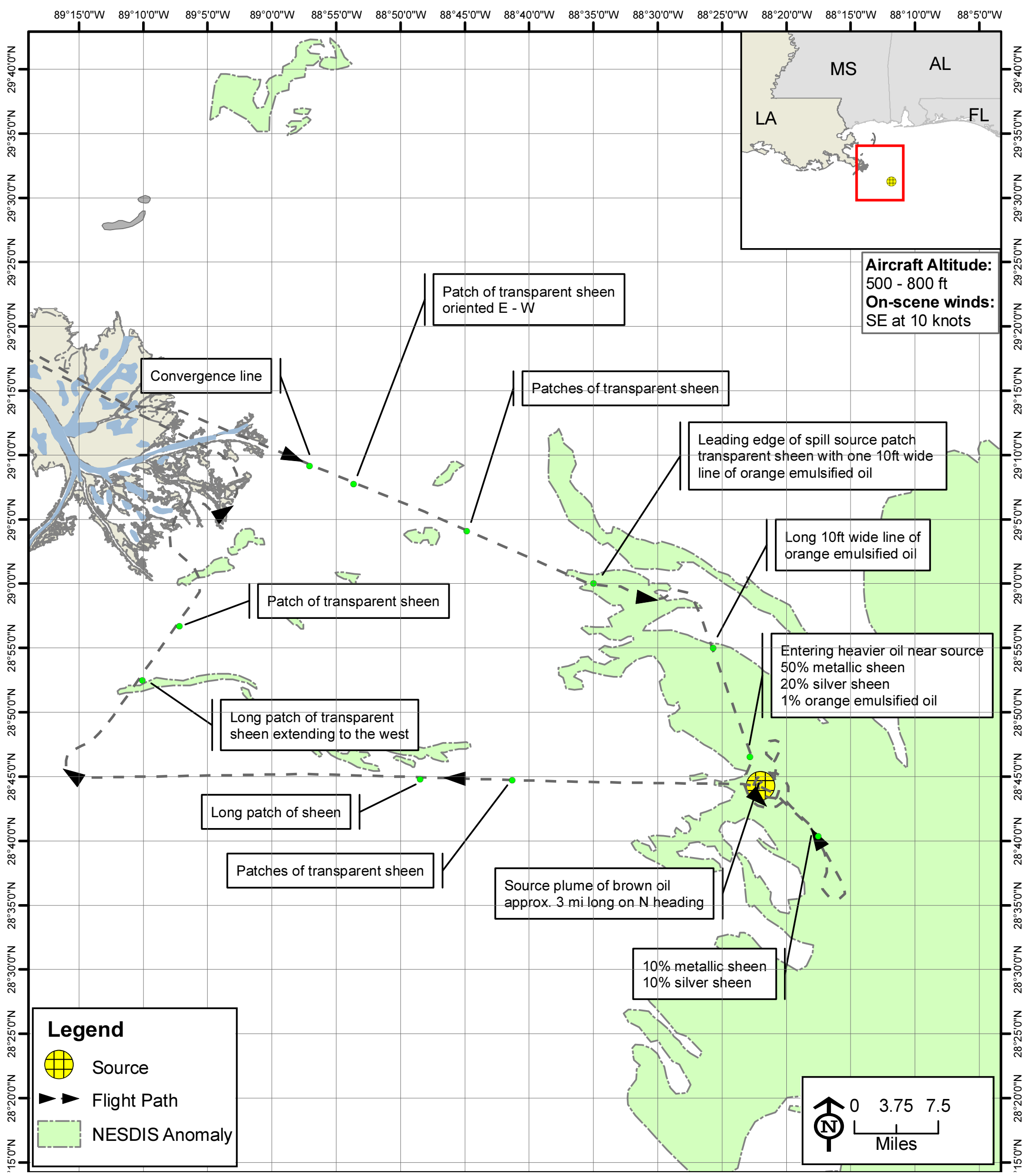
From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 12, 2010 9:12:44 AM EDT
To: Debbie French McCay <DFrenchMcCay@asascience.com>
Cc: Daniel Hahn <Daniel.Hahn@noaa.gov>
Subject: Re: Today's overflight.

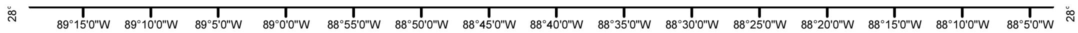
It was the note on the attached. "Source plume of brown oil approx. 3 mi long on N heading"

Mississippi Canyon 252, Gulf of Mexico

Type of Map: Overflight
Prepared by: NOAA
USE ONLY AS A GENERAL REFERENCE

Date/Time: 05-11-2010 / 1405-1605hrs CDT
Platform: Sikorsky S-76
Observers: Sulfridge (USCG) Wesley (NOAA) Slater (NOAA)





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Daniel Hahn, Ph.D.
Regional Resource Coordinator
National Oceanic and Atmospheric Administration
Assessment & Restoration Division, SE Region
263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: (727) 551-5715
Fax: B6 Privacy

Cell: [redacted] <Classification_5-10-10_0900CDT.jpg><2010May12-0130gmt-42916_5day.png>

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

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[redacted] Cell

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 12, 2010 9:23:55 AM EDT
To: Debbie French McCay <DFrenchMcCay@asascience.com>
Cc: Daniel Hahn <Daniel.Hahn@noaa.gov>
Subject: Re: Today's overflight.

The ocean imaging stuff is pretty useful. What is the access site for that.
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55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
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From: Daniel Hahn [Daniel.Hahn@noaa.gov]
Sent: Tuesday, May 11, 2010 9:10 PM
To: Tom Moore
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Subject: Re: Today's overflight.

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[redacted] Cell

Begin forwarded message:

From: Debbie French McCay <DFrenchMcCay@asascience.com>
Date: May 12, 2010 9:30:34 AM EDT
To: Tom Moore <Tom.Moore@noaa.gov>, Nicole Mulanaphy <NMulanaphy@asascience.com>
Cc: Daniel Hahn <Daniel.Hahn@noaa.gov>
Subject: **RE: Today's overflight.**

Tom and Dan,
See attached, best so far. Nicole Mulanaphy is getting these downloaded (take a long time) and working with the GIS to get shape files.

Nicole,
Please send access info to Tom and Dan, and explain system -- point them at the pdfs.

Thanks
Deb

Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted]

____
From: Tom Moore [Tom.Moore@noaa.gov]

Sent: Wednesday, May 12, 2010 9:23 AM
To: Debbie French McCay
Cc: Daniel Hahn
Subject: Re: Today's overflight.

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On May 12, 2010, at 12:28 AM, Debbie French McCay wrote:

> Tom and Dan,
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> d.french.mccay@asascience.com
> voc: [redacted]
> ____
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> Sent: Tuesday, May 11, 2010 9:10 PM
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> Regional Resource Coordinator
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> 263 13th Avenue South
> St. Petersburg, FL 33701
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> email: Daniel.Hahn@noaa.gov

Phone: (727) 551-5715
Fax: [redacted]
Cell: [redacted] <Classification_5-10-10_0900CDT.jpg><2010May12-0130gmt-42916_5day.png>

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

[redacted] Office
[redacted] Cell

May4-9-OI ....zip (870 KB)

Begin forwarded message:

From: Brenda Jones <bkjones@usgs.gov>
Date: May 12, 2010 10:23:34 AM EDT
To: 1AF.A2.ALL.Branchchiefs@tyndall.af.mil, 240cbcsev4@scmcen.ang.af.mil, 601aoc.isrops@tyndall.af.mil, 601AOC.ISRDPEDTeam@tyndall.af.mil, 601AOC <601AOC/ISRD.SUPPORT@tyndall.af.mil>, afnorth.a2.omb@tyndall.af.mil, alan.springett@fema.gov, Albert.Mongeon@noaa.gov, alice.reece@northcom.mil, allan.richards.ctr@northcom.mil, anayegandhi@usgs.gov, andrea.donnellan@jpl.nasa.gov, andrew.berquist@doc.as, andrew.j.bruzewicz@usace.army.mil, andrew.r.kalukin@nga.mil, angie.watkins@ema.alabama.gov, anthony.muir@tyndall.af.mil, asallenger@usgs.gov, Aimee.Preau@dhs.gov, Allan.Richards.ctr@northcom.mil, Amy.Merten@noaa.gov, Andrew.Souza@northcom.mil, Ashley.Summers@tpwd.state.tx.us, Bill.Lehr@noaa.gov, bkaplan@cdc.gov, bmooney@wlf.la.gov, Bob Bewley <Bob_Bewley@blm.gov>, brenda.wisham@TYNDALL.AF.MIL, brent.meyer@northcom.mil, brent.t.johnson@us.army.mil, brent.yantis@rac.louisiana.edu, brian.t.tracy@usace.army.mil, brian.vanderbilt@slc.usda.gov, brian_collins@sra.com, broche@usgs.gov, Bruce A Bauch <bbauch@usgs.gov>, bruce.townsend@TYNDALL.AF.MIL, bryan.e.baker@usace.army.mil, bryan.ossolinski@northcom.mil, bryan.williams8@us.army.mil, buchanan_p@srwmd.state.fl.us, burhan.girgin@ng.army.mil, byron.g.williams@usace.army.mil, Bill.Majors@ang.af.mil, Brady Couvillion <couvillionb@usgs.gov>, Brad_Segrest@deq.state.ms.us, Brenda Ellis <bellis@usgs.gov>, Brent D Johnson <bdjohn@usgs.gov>, Brian.Crumpler@vdem.virginia.gov, Brian.Plaisted@smdc-cs.army.mil, Bruce.B.Heinlein@nga.mil, Bruce.Heinlein@dia.mil, caesar.kellum@tyndall.af.mil, Calvin P O'Neil <o'neilp@usgs.gov>, cameron tongier <Cameron_Tongier@fws.gov>, Carol L Giffin <clgiffin@usgs.gov>, Carol L Ostergren <costergren@usgs.gov>, carrol.harvey.ctr@northcom.mil, cblevins@ofda.gov, cdevaugh@usgs.gov, cgohara@gri.msstate.edu, chad.liebergen@tyndall.af.mil, charles.c.cobb@ng.army.mil, chill@gri.msstate.edu, chrisj@gstac.org, christina.mccullough@us.army.mil, Christopher.Jackson@noaa.gov, ckaiser@cct.lsu.edu, claudette.fetterman@dhs.gov, clint.padgett@us.army.mil, clocke@researchplanning.com, clyde.harshbarger@camarc.ang.af.mil, cmundy@sjrwmd.com, cpenni2@lsu.edu, creefee@hotmail.com, cretinic@usgs.gov, Cameron.Ray@ang.af.mil, Carolyn Gacke <cgacke@usgs.gov>, Chad.A.Markin@usace.army.mil, Charles.Armbruster@LA.GOV, Christopher J Wells <wellsc@usgs.gov>, Christopher.s.Vaughan@nga.mil, Clifford.A.Jordan@nga.mil, Colleen W Charles <colleen_charles@usgs.gov>, dacres_karen@bah.com, daniel.redieske@associates.dhs.gov, danielson.jeff@epa.gov, dave.barton@nwfwmd.state.fl.us, dave.kahle@northcom.mil, David D Greenlee <greenlee@usgs.gov>, david.j.petit@usace.army.mil, david.lawson@dhs.gov, david.nabity@slc.usda.gov, david.w.couch@us.army.mil, dbraud1@lsu.edu, dce6dep@gmail.com, Denis.Riordan@noaa.gov, dennis.varela@tyndall.af.mil, dgisclair@lsu.edu, dmcdonald@sfasu.edu, donald.v.sullivan@nasa.gov, donna.glover@dhs.gov, Doug.Marcy@noaa.gov, dshaw@gri.msstate.edu, dsmith@synergist-tech.com, David A Kirtland <dakirtland@usgs.gov>, David E Bortnem <debortnem@usgs.gov>, David L Saghy <dsaghy@usgs.gov>, David P Bornholdt <dbornholdt@usgs.gov>, David.Beach.ctr@northcom.mil, David.W.Arber@nga.mil, Davida.Streett@noaa.gov, David_Behler@ios.doi.gov, Dean.Taylor.ctr@northcom.mil, Dean_Ross@nps.gov, DeepWaterHorizonResponseTeam@nga.mil, Denise.L.Anderson@nga.mil, Derrick.J.Isaac@uscg.mil, Donnie.B.Self@nga.mil, DOI_Watch_Office@ios.doi.gov, ecarter@sjrwmd.com, edward.g.boyle@us.army.mil, ehinkley@fs.fed.us, elizabeth.matlack@associates.dhs.gov, ellile@usgs.gov, ellis.bailey@dot.state.fl.us, emily.hale@navy.mil, eric.lamberson@conus.army.mil, eric.s.ensign@uscg.mil, eric.t.calvert@us.army.mil, eric.zitz@associates.hq.dhs.gov, Erik.Hund@noaa.gov, eugene.robinson@northcom.mil, Elena_Robisch@nps.gov, Elijah W Ramsey <ramseye@usgs.gov>, Eric.W.Berkowitz@noaa.gov, filippi@tamu.edu, frank.changa@dhs.gov, freckmanna@saic.com, Frank.Barnett@ang.af.mil, g.robert.brakenridge@Dartmouth.EDU, gary.zimmerer@dhs.gov, gayla.mullins@tnris.state.tx.us, Gene Nelson <nelsong@usgs.gov>, George.Graettinger@noaa.gov, gerald.buckmaster@TYNDALL.AF.MIL, gforthun@emd.sc.gov, gheleine@usgs.gov, glen.r.russell@uscg.mil, glenn.bethel@fas.usda.gov, glenn.k.frano@erdc.usace.army.mil, glmerrill@usgs.gov, gr8savage@yahoo.com, Gregory I Snyder <gsnyder@usgs.gov>, gregory.pollock@us.army.mil, gwells@csr.utexas.edu, gzhou@odu.edu, Gary B Fisher <gfisher@usgs.gov>, Gerald.Danussi@northcom.mil, GS-I-HQ GIC EmOps Contacts <GS-I-HQ_GIC_EmOps_Contacts@usgs.gov>, hampton@lsu.edu, hardytr@saic.com, Harry C McWreath

<hmcwreath@usgs.gov>, Henry B Wolter <hwolter@usgs.gov>, hmorgan@ncem.org, howard@csr.utexas.edu, Harry C McWreath <hmcwreath@usgs.gov>, ia-rprogramsoffice@hq.dhs.gov, Irene.M.Brodley@nga.mil, jack.b.smith@usace.army.mil, jack.wurts.ctr@hanscom.af.mil, jacob.d.rothberger@usace.army.mil, james.burgess@scmcen.ang.af.mil, james.e.pearson@nga.mil, james.g.jaspers@saj02.usace.army.mil, james.g.neighbors@nga.mil, janelle.worstell@TYNDALL.AF.MIL, jbrass@mail.arc.nasa.gov, jcameron@sfwmd.gov, jduncan@usgs.gov, Jean W Parcher <jwparcher@usgs.gov>, Jeff L Sloan <jlsloan@usgs.gov>, jeff.lillycrop@sam.usace.army.mil, jeffery.fuller@us.army.mil, jeffrey.a.busch@nga.mil, jeffrey.dyball@northcom.mil, jeffrey.k.miller@us.army.mil, jeff_harrington@sra.com, jeniefer j pryor <pryorj@usgs.gov>, Jennifer.Belge@noaa.gov, jennifer.heys-smith@dia.mil, jennifer.s.macpherson@usace.army.mil, jennifer.s.makowski@uscg.mil, jennifer.wozencraft@us.army.mil, jeremy.burr@associates.dhs.gov, Jill.Bodnar@noaa.gov, 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oskar@mail.utexas.edu, parrish.david@epa.gov, patrick.kuegel@pentagon.af.mil, paul.clouse@usace.army.mil, peter.wiedel@scmcen.ang.af.mil, philip.baylis@northcom.mil, philip.d.wilson@ugov.gov, philip.d.wilson@uscg.mil, pmhipersonnel@nga.mil, pmhr@nga.mil, prblackwell@sfasu.edu, Peter.Wiedel@ang.af.mil, Philip.Baylis@northcom.mil, Ralph Storey <jstorey@usgs.gov>, randall.w.berthold@nasa.gov, rex.forney@us.army.mil, richard.butgereit.em@gmail.com, richard.butgereit@em.myflorida.com, richard.hardy@conus.army.mil, rjacokes@fs.fed.us, rlonghenry@usgs.gov, Robb.Wright@noaa.gov, robert.a.rapanut@nga.mil, robert.barber-delach@ngb.army.mil, robert.barron@glo.state.tx.us, robert.bell.1@ang.af.mil, robert.c.barnard@saic.com, robert.l.mcdowell.ctr@nga.mil, robert.reininger@northcom.mil, robert.w.corn@erdc.usace.army.mil, robert.w.corn@usace.army.mil, roche.brittany@epa.gov, roger.saul@ang.af.mil, roger.trevino@faa.gov, roger.ward@SMDC-CS.ARMY.MIL, rolando.rivero@dhs.gov, Ronald H Keeler 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stuart.yaap@northcom.mil, susan_stitt@usgs.gov, swalter@usgs.gov, Sander.J.Williams@nga.mil, Scott.Bourne@usace.army.mil, Scott.Cappelluti@nga.mil, Shawn.S.Koch@uscg.mil, Shelly.Tabar@dhs.gov, Sonia.Gallegos@nrlssc.navy.mil, Staci.King@mms.gov, Stanley.A.Gold@USCG.MIl, Stephen E Hammond <sehammon@usgs.gov>, Steven.G.Alness@nga.mil, tara.burkey@us.army.mil, teri.alberico@usace.army.mil, theodore.polet@us.army.mil, Thomas H Cecere <tcecere@usgs.gov>, thomas.humber.ctr@northcom.mil, Tim.Osborn@noaa.gov, tim.ruhren@cscic.state.ny.us, Timothy W Saultz <tsaultz@usgs.gov>, todd.patton@northcom.mil, Tom.Moore@noaa.gov, troy.wilkerson@scmcen.ang.af.mil, tugwellr@nga.mil, tuneg@usa.redcross.org,

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Subject: DEEPOIL Oilspill remote sensing telecon today at 1300CDT

We will be having a remote sensing working group telecon today at 1400 EDT, 1300CDT, 1200MDT, and 1100PDT. The notes from Saturday and Tuesday are attached.

Dial in - B6 Privacy [redacted]#

Participant Feature Keys	
* 3	Exit - exit the call
* 4	Instructions - conference instructions
* 6	Mute/Unmute - caller controlled muting

Following is a brief agenda - I have not confirmed participation.
1. Introductions
2. NOAA update
3. USCG update
4. EagleVision
5. NGA
6. NASA/ASTER
7. IRSCC
8. EPA
9. USDA
10. States
11. Roundtable

Brenda K. Jones
Disaster Response Coordinator
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Phone 605.594.6503
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Email: bkjones@usgs.gov
FOR EMERGENCIES
CELL: B6 Privacy [redacted]

RSWG_0511....doc (34.5 KB)

RSWG_0508....doc (32.5 KB)

Begin forwarded message:

From: "M.E. Rolle" <MaryElliott.Rolle@noaa.gov>
Date: May 12, 2010 10:38:46 AM EDT
To: "'Mike.Buchman@noaa.gov'" <Mike.Buchman@noaa.gov>
Cc: Tom Moore <Tom.Moore@noaa.gov>, Troy Baker <Troy.Baker@noaa.gov>
Subject: [Fwd: Gulf oil and deep coral]

FYI on coral interests at USGS.

[redacted]

[redacted]

[redacted] *Referral to USGS* [redacted]

[redacted]

[redacted]

[redacted]

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 12, 2010 10:48:49 AM EDT
To: Mary Elliott Rolle <MaryElliott.Rolle@noaa.gov>
Cc: Mike Buchman <Mike.Buchman@noaa.gov>, Troy Baker <Troy.Baker@noaa.gov>, Ian J Zelo <ian.j.zelo@noaa.gov>, "hahn >> Daniel Hahn" <Daniel.Hahn@noaa.gov>, Rob Ricker <Rob.Ricker@noaa.gov>
Subject: Fwd: [Fwd: Gulf oil and deep coral]

We probably want to get in front of this on the NRDA side before others in NOAA and DOI start to spin a up a plan for looking at deep coral impacts.   I am not a deep coral expert but from the looking at the data available for the northern gulf this is certainly an issue we'll need to take a close look at.

Mike and Ian were going to talk after today's call to figure out the best way to spin up a coral group. I am happy to help as needed.

Begin forwarded message:

> **From:** "M.E. Rolle" <MaryElliott.Rolle@noaa.gov>
> **Date:** May 12, 2010 10:38:46 AM EDT
> **To:** "'Mike.Buchman@noaa.gov'" <Mike.Buchman@noaa.gov>
> **Cc:** Tom Moore <Tom.Moore@noaa.gov>, Troy Baker <Troy.Baker@noaa.gov>
> **Subject: [Fwd: Gulf oil and deep coral]**
>
> FYI on coral interests at USGS.
>
> -------- Original Message --------
> **Subject:** Gulf oil and deep coral

[redacted]

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

Begin forwarded message:

From: Nicole Mulanaphy <NMulanaphy@asascience.com>
Date: May 12, 2010 10:56:56 AM EDT
To: Tom Moore <Tom.Moore@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>
Cc: Debbie French McCay <DFrenchMcCay@asascience.com>
Subject: **RE: Today's overflight.**

Hi Tom and Dan,

The Ocean Imaging data is on their ftp site. The details are:

[redacted]

[redacted]

On the ftp site are the raster files (for ArcGIS) that contains all of the data, there is information on their flight path and the oil classification (i.e. thickness, emulsion, sheen, ect.). For some of the days there are pdfs. This is what Debbie attached in her previous email. The site currently has data for May 5th through May 11th. I have downloaded all of the data (very large files) and I am processing them into ArcGIS shape files (smaller file size than the raster files). The shape file do not have the fine 2m resolution like the raster files, but the file size is smaller and easier to work with.

There are no pdfs on the ftp site for May 10th or May 11th. I am in the process of creating an image, I will send this to you shortly. If you are interested I could provide you the pdf/image for each day that there is data on the ftp site as we move forward. Let me know if you would like me to do that.

Also, if you are interested I can provide you with the processed shape files if you would like.

Thanks!
Nicole

Nicole Whittier Mulanaphy l Environmental Chemical Engineer
Applied Science Associates, Inc.
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e: nmulanaphy@asascience.com l www.asascience.com

ASA l Science. Services. Solutions.

-----Original Message-----
From: Debbie French McCay
Sent: Wednesday, May 12, 2010 9:31 AM
To: Tom Moore; Nicole Mulanaphy
Cc: Daniel Hahn
Subject: RE: Today's overflight.

Tom and Dan,
See attached, best so far. Nicole Mulanaphy is getting these downloaded (take a long time) and working with the GIS to get shape files.

Nicole,
Please send access info to Tom and Dan, and explain system -- point them at the pdfs.

Thanks
Deb

Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted]

From: Tom Moore [Tom.Moore@noaa.gov]
Sent: Wednesday, May 12, 2010 9:23 AM

To: Debbie French McCay
Cc: Daniel Hahn
Subject: Re: Today's overflight.

The ocean imaging stuff is pretty useful. What is the access site for that.
On May 12, 2010, at 12:28 AM, Debbie French McCay wrote:

> Tom and Dan,
>
> I am not seeing what you saw about the plume going north. These are notes in an overflight this afternoon?
>
> The Payne cruise is going to sample the rising plume tomorrow am and all indications I can find show that the rising plume extends to the east. The ADCP shows eastward currents in the surface layer (to 100 deg. about 0.7 kts), and the currents 100-300m down are ~0.2 kts to NE. Net seems to be about due east. See vector plot attached. This is at:
> http://www.ndbc.noaa.gov/station_page.php?station=42916
>
> Attached is an Ocean Imaging overflight interpretaions from 0900cdt May 10, the most recent we have. At that time yesterday, the eastward plume was 1.5km = 0.8nmile long. This seems to be the untreated oil coming up. The southward plume is unclear, might be from dispersant-injected oil coming up more slowly and being carried south in deeper waters. These features have been present for a few days now.
>
> We'd like the Sipper to sample both these plumes. Ocean Imaging should be up flying again soon (was not today), so we should get more by the 14th.
>
> Deb
>
> Deborah French McCay
> Applied Science Associates, Inc. (ASA)
> 55 Village Square Drive
> South Kingstown, RI 02879 USA
> d.french.mccay@asascience.com
> voc: [redacted] B6 Privacy
> ____
> From: Daniel Hahn [Daniel.Hahn@noaa.gov]
> Sent: Tuesday, May 11, 2010 9:10 PM
> To: Tom Moore
> Cc: Debbie French McCay
> Subject: Re: Today's overflight.
>
> Agreed that is would be good to have dave relay information back to us
> the days leading up to our time in the plume.
> Dan
>
> Tom Moore wrote:
>> Check out the notes on the afternoon overflight today. Plume is noted as 3nm long but it seems to suggest it is going north of the source...
>>
>> Maybe we should follow-up with Dave, it would also be good for those guys to know our ops plan for the spill area so they can relay pertinent information.
>>
>> Sent from my iPad
>
> --
> Daniel Hahn, Ph.D.
> Regional Resource Coordinator
> National Oceanic and Atmospheric Administration Assessment &
> Restoration Division, SE Region
> 263 13th Avenue South
> St. Petersburg, FL 33701
>
> email: Daniel.Hahn@noaa.gov

Phone: (727) 551-5715
Fax: [redacted]
Cell: [redacted] <Classification_5-10-10_0900CDT.jpg><2010May12-0130gmt-42916_5day.png>

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell
Begin forwarded message:

From: Daniel Hahn <Daniel.Hahn@noaa.gov>
Date: May 12, 2010 11:26:08 AM EDT
To: tom Moore <Tom.Moore@noaa.gov>
Subject: [Fwd: DWHOS - Summary of Historical and Current Fish/Invert data in GOM]

the database compilation is being taken care of elsewhere but if you can follow up on contacts and information of longline fisheries as described below, that would be great.
Dan

-------- Original Message --------
Subject: DWHOS - Summary of Historical and Current Fish/Invert data in GOM
Date: Mon, 10 May 2010 21:22:55 -0400
From: Jill Rowe <jrowe@asascience.com>
To: Daniel.Hahn@noaa.gov <Daniel.Hahn@noaa.gov>
CC: Debbie French McCay <DFrenchMcCay@asascience.com>

Dan,

Attached please find the summary that I've put together for the historical and current databases for fish and invertebrates in the Gulf of Mexico. There are a number of gaps that I think the individual states will be able to fill in, but atleast it's a good starting point. Also, I would like to talk to someone at NMFS SEFSC to discuss the status and content of their longline database, but I'm not sure who might be a good person to contact? Do you have any ideas? Sampling of the offshore fish densities is going to be one of our biggest data gaps, and will most likely require more effort. Also, have you ever heard of using a recordable fish finder or EK 60, as suggested by Jan Roletto (NOAA) below? I've included a brochure about the device and would like to discuss this with the NMFS SEFSC people, as well, to see if they've ever used something similar for sampling.

Thanks,
Jill

Jill Rowe | Biologist
Applied Science Associates, Inc.
55 Village Square Drive | South Kingstown, RI 02879 USA
p: +1 401 789-6224, ext. 329 | f: +1 401 789-1932
e: jrowe@asascience.com | www.asascience.com

ASA | Science. Services. Solutions.

-----Original Message-----
From: Debbie French McCay
Sent: Thursday, May 06, 2010 4:24 PM
To: Jill Rowe
Subject: FW: Deepwater Horizon - Dispersants and water column damages

If I sent this already, please ignore, but I think I deleted by mistake before I sent it.

WHEN time, see what this acoustic approach to measuring biomass might be -- is there such a techniq
ue?
Thanks

Deborah French McCay, PhD
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879
(office) [redacted]
(fax) [redacted]
dfrenchmccay@asascience.com or
d.french.mccay@asascience.com

-----Original Message-----
From: Jan Roletto [mailto:Jan.Roletto@noaa.gov]
Sent: Thursday, May 06, 2010 2:03 PM
To: Debbie French McCay
Cc: Patrick Rutten; jrpayne@sbcglobal.net; Maria Brown; Lisa Symons; Rob Ricker; Robert A Taylor; L
aurie Sullivan; Eileen Graham; Jennifer Cragan
Subject: Re: Deepwater Horizon - Dispersants and water column damages

Hi Debbie:

Sounds great. Good to hear you're on it!

Is it possible that the vessel has a recordable fish finder, if not an
ER or EK 60, for recoding underway water column biomass? If not, is it
possible to have a second vessel follow the same track line, within 12
hours of the initial vessel, with some type of recordable fish finder or
EK 60?

Best, Jan

--
Daniel Hahn, Ph.D.
Regional Resource Coordinator
National Oceanic and Atmospheric Administration
Assessment & Restoration Division, SE Region
263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: (727) 551-5715
Fax: [redacted]
Cell: [redacted]

EK60-fishfinder.pdf (3.5 MB)
Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 12, 2010 11:40:47 AM EDT
To: DWHNRDA.Cruise1@gmail.com
Subject: **Surfacing and deepwater plume locations**

Melanie should be able to help interpret this information... Were using this info to target final spill area sampling. 1 jpg, and 2 ZIP files attached.

Laurie, Rob, Troy,
See also attached Ocean Imaging interpretations of remote sensing with oil thickness. Fresh thick oil should be surfacing oil.
Deb

Laurie, Dan, Tom,

Attached are my model results for 5AM today using the measured currents at the wellhead (ADCP). The Payne cruise should be sampling where oil is coming up and in the surface waters, but note the narrow plume. The 100 deg 8km out position is where I placed him last night, and he reported they were at P1 position at 8am running the ROV. The plan is they go from P1 toward P4. If you look at the pictures, I think the deep plume at the bottom is close to the wellhead and just SW, but also at P3 (between P2 and P4). You can see this is a tough thing to sample. This is why I think we need more sampling out there. The Sipper sampling will be a big help.

I have been discussing the deep plume modeling with CJ Beegle-Krause, who is lead on that for the response. OK that we share model predictions? I can cc Robert and Stephanie on any emailed pictures, but will keep discussions on the phone.

Thanks,
Deb

The Payne cruise is going to sample the rising plume tomorrow am and all indications I can find show that the rising plume extends to the east. The ADCP shows eastward currents in the surface layer (to 100 deg. about 0.7 kts), and the currents 100-300m down are ~0.2 kts to NE. Net seems to be about due east. See vector plot attached. This is at:
http://www.ndbc.noaa.gov/station_page.php?station=42916

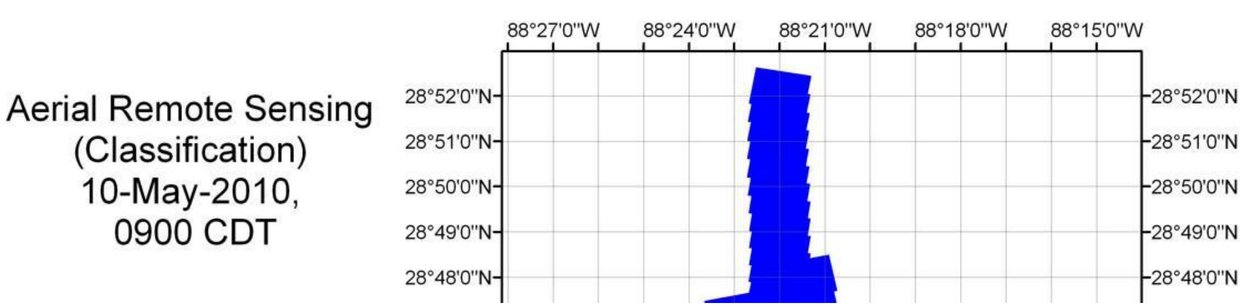
Attached is an Ocean Imaging overflight interpretaions from 0900cdt May 10, the most recent we have. At that time yesterday, the eastward plume was 1.5km = 0.8nmile long. This seems to be the untreated oil coming up. The southward plume is unclear, might be from dispersant-injected oil coming up more slowly and being carried south in deeper waters. These features have been present for a few days now.

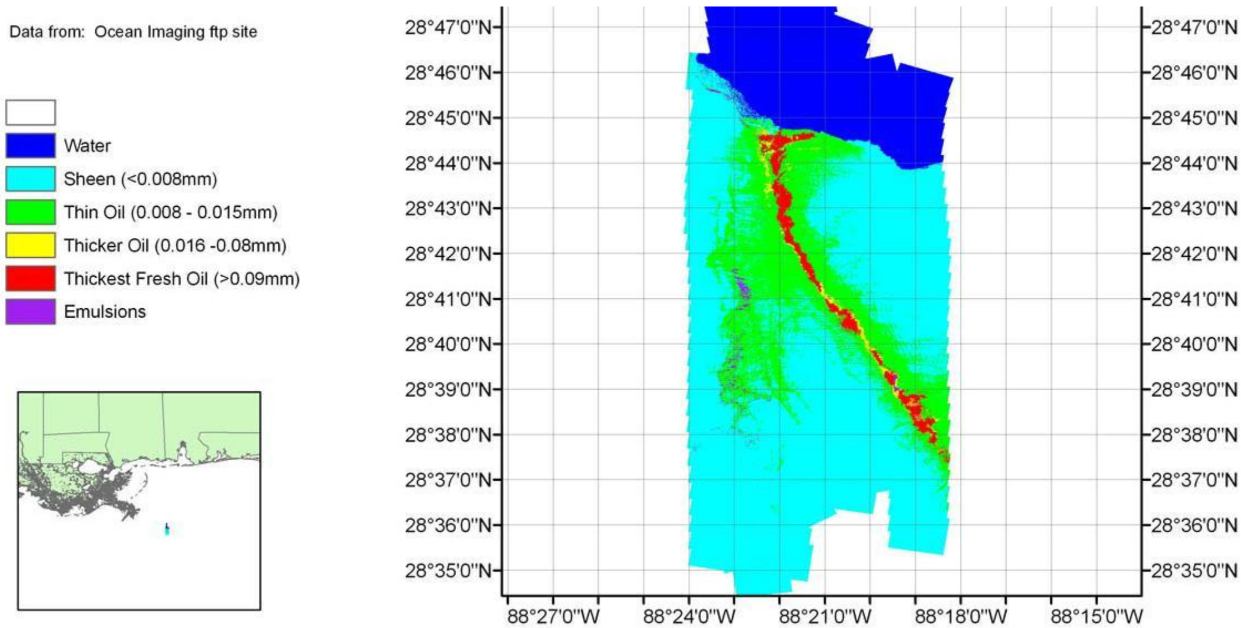
We'd like the Sipper to sample both these plumes. Ocean Imaging should be up flying again soon (was not today), so we should get more by the 14th.

Deb

SIMAP-mode....zip (230 KB)

May4-9-OI_....zip (870 KB)





Begin forwarded message:

From: Nicole Mulanaphy <NMulanaphy@asascience.com>
Date: May 12, 2010 12:50:21 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>
Cc: Debbie French McCay <DFrenchMcCay@asascience.com>
Subject: **RE: Today's overflight.**

Hi Tim and Dan,

Attached are images that display the remote sensing performed by Ocean Imaging for May 10th and May 11th. There is an AM and PM for May 10th. Currently there is only an AM for May 11th, if they did a fly over in the PM they are still processing the data. As soon as it is on the ftp site I will send you an image.

Thanks!
Nicole

Nicole Whittier Mulanaphy l Environmental Chemical Engineer
Applied Science Associates, Inc.
55 Village Square Drive l South Kingstown, RI 02879 USA
p: +1 401 789-6224 l f: +1 401 789-1932
e: nmulanaphy@asascience.com l www.asascience.com

ASA l Science. Services. Solutions.

-----Original Message-----
From: Nicole Mulanaphy
Sent: Wednesday, May 12, 2010 10:57 AM
To: Tom Moore; Daniel Hahn
Cc: Debbie French McCay
Subject: RE: Today's overflight.

Hi Tom and Dan,

The Ocean Imaging data is on their ftp site. The details are:

[redacted]

B6 Privacy

On the ftp site are the raster files (for ArcGIS) that contains all of the data, there is information on their flight path and the oil classification (i.e. thickness, emulsion, sheen, ect.). For some of the days there are pdfs. This is what Debbie attached in her previous email. The site currently has data for May 5th through May 11th. I have downloaded all of the data (very large files) and I am processing them into ArcGIS shape files (smaller file size than the raster files). The shape file do not have the fine 2m resolution like the raster files, but the file size is smaller and easier to work with.

There are no pdfs on the ftp site for May 10th or May 11th. I am in the process of creating an image, I will send this to you shortly. If you are interested I could provide you the pdf/image for each day that there is data on the ftp site as we move forward. Let me know if you would like me to do that.

Also, if you are interested I can provide you with the processed shape files if you would like.

Thanks!
Nicole

Nicole Whittier Mulanaphy l Environmental Chemical Engineer
Applied Science Associates, Inc.
55 Village Square Drive   l   South Kingstown, RI 02879 USA
p: +1 401 789-6224 l f: +1 401 789-1932
e: nmulanaphy@asascience.com l www.asascience.com

-----Original Message-----
From: Debbie French McCay
Sent: Wednesday, May 12, 2010 9:31 AM
To: Tom Moore; Nicole Mulanaphy
Cc: Daniel Hahn
Subject: RE: Today's overflight.

Tom and Dan,
See attached, best so far. Nicole Mulanaphy is getting these downloaded (take a long time) and working with the GIS to get shape files.

Nicole,
Please send access info to Tom and Dan, and explain system -- point them at the pdfs.

Thanks
Deb

Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: B6 Privacy

From: Tom Moore [Tom.Moore@noaa.gov]
Sent: Wednesday, May 12, 2010 9:23 AM
To: Debbie French McCay
Cc: Daniel Hahn
Subject: Re: Today's overflight.

The ocean imaging stuff is pretty useful. What is the access site for that.
On May 12, 2010, at 12:28 AM, Debbie French McCay wrote:

> Tom and Dan,
>
> I am not seeing what you saw about the plume going north. These are notes in an overflight this afternoon?
>
> The Payne cruise is going to sample the rising plume tomorrow am and all indications I can find show that the rising plume extends to the east. The ADCP shows eastward currents in the surface layer (to 100 deg. about 0.7 kts), and the currents 100-300m down are ~0.2 kts to NE. Net seems to be about due east. See vector plot attached. This is at:
> http://www.ndbc.noaa.gov/station_page.php?station=42916
>
> Attached is an Ocean Imaging overflight interpretaions from 0900cdt May 10, the most recent we have. At that time yesterday, the eastward plume was 1.5km = 0.8nmile long. This seems to be the untreated oil coming up. The southward plume is unclear, might be from dispersant-injected oil coming up more slowly and being carried south in deeper waters. These features have been present for a few days now.
>
> We'd like the Sipper to sample both these plumes. Ocean Imaging should be up flying again soon (was not today), so we should get more by the 14th.
>
> Deb
>
> Deborah French McCay
> Applied Science Associates, Inc. (ASA)
> 55 Village Square Drive
> South Kingstown, RI 02879 USA
> d.french.mccay@asascience.com
> voc: B6 Privacy
>
> ---
>
> From: Daniel Hahn [Daniel.Hahn@noaa.gov]
> Sent: Tuesday, May 11, 2010 9:10 PM
> To: Tom Moore
> Cc: Debbie French McCay
> Subject: Re: Today's overflight.
>
> Agreed that is would be good to have dave relay information back to us
> the days leading up to our time in the plume.
> Dan
>
> Tom Moore wrote:
>> Check out the notes on the afternoon overflight today. Plume is noted as 3nm long but it seems to suggest it is going north of the source...

Maybe we should follow-up with Dave, it would also be good for those guys to know our ops plan for the spill area so they can relay pertinent information.

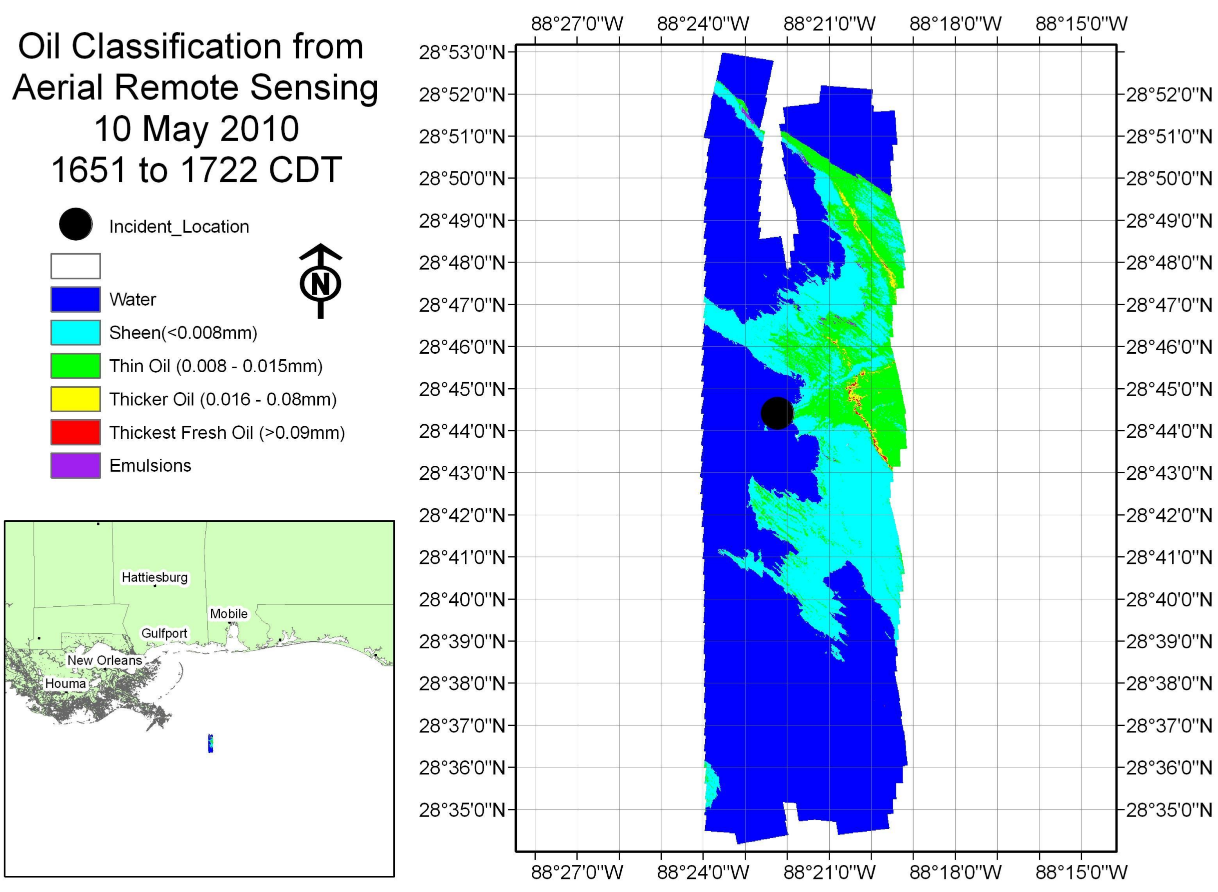
Sent from my iPad

--
Daniel Hahn, Ph.D.
Regional Resource Coordinator
National Oceanic and Atmospheric Administration Assessment &
Restoration Division, SE Region
263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: [redacted] B6 Privacy
Fax: [redacted] B6 Privacy
Cell: [redacted] B6 Privacy <Classification_5-10-10_0900CDT.jpg><2010May12-0130gmt-42916_5day.png>

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

[redacted] B6 Privacy Office
[redacted] B6 Privacy Cell



Data from: Ocean Imaging
Prepared by: N.Mulanaphy (ASA)

0 6,250 12,500 25,000 Meters

Oil Classification from Aerial Remote Sensing
11 May 2010
0905 to 1013 CDT

Incident_Location

No Data

Water

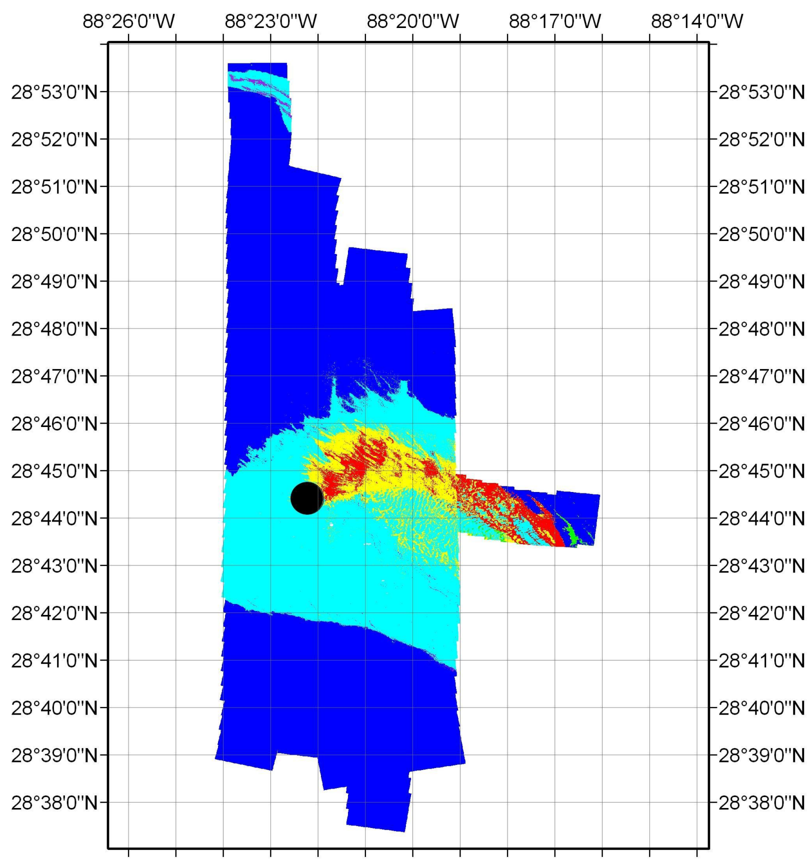
Sheen (<0.008mm)

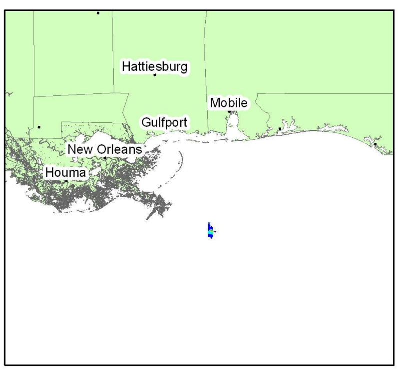
Thin Oil (0.008-0.015mm)

Thicker Oil (0.016-0.08mm)

Thickest Fresh Oil (>0.09mm)

N





Data from: Ocean Imaging
Prepared by: N.Mulanaphy (ASA)

0 5,500 11,000 22,000 Meters

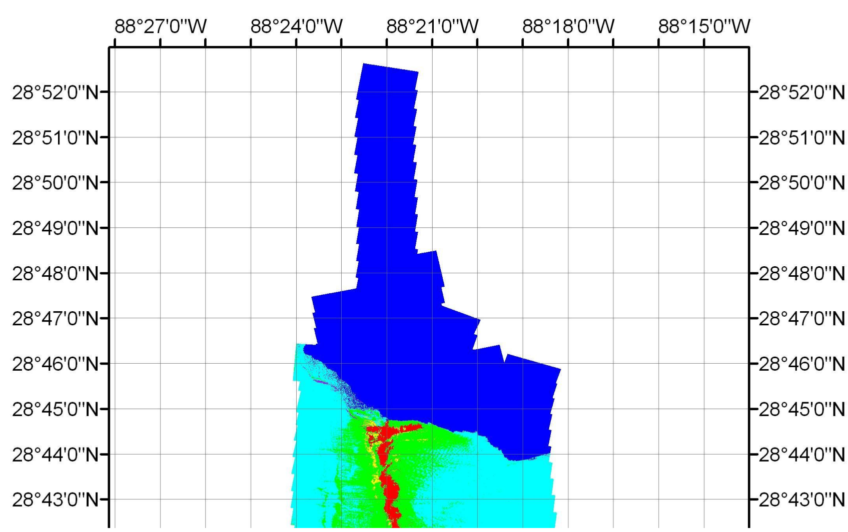
Aerial Remote Sensing (Classification)
10-May-2010,
0900 CDT

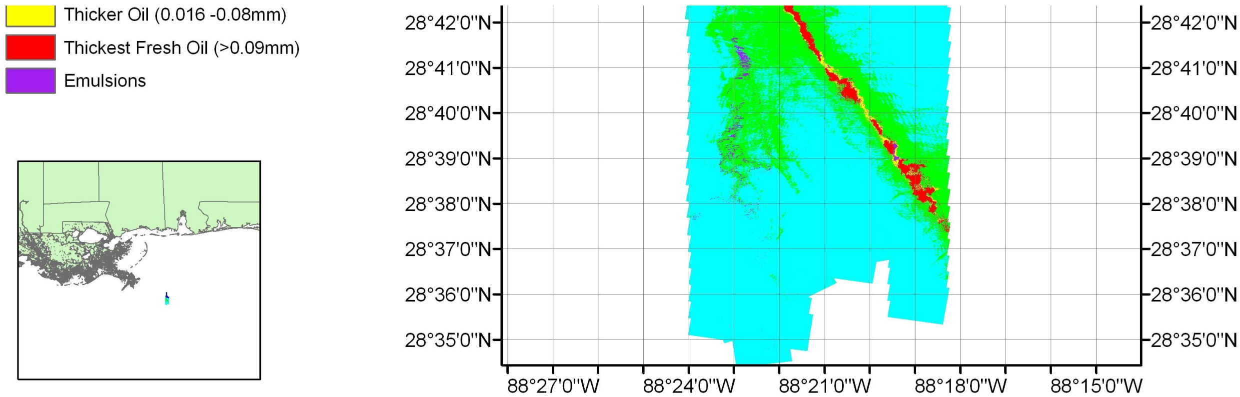
Data from: Ocean Imaging ftp site

Water

Sheen (<0.008mm)

Thin Oil (0.008 - 0.015mm)





Begin forwarded message:

From: "Polk, Daniel" <Daniel.Polk@bp.com>
Date: May 12, 2010 3:26:53 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Subject: RE: DWH - R/V Weatherbird Spill Site Operations 5/14&15

You are correct, talk to you then.
Remember to call the Field Branch SIMOPS Coordinator Scott Orr and Angel Rodriguez on board the Development Driller 3 for field entry and if your vessel needs any assistance.
Best regards,
Dan

Daniel Polk
Marine Operations Lead
BP Exploration & Production, GoM
Mobile: B6 Privacy
daniel.polk@bp.com

-----Original Message-----
From: Tom Moore [mailto:Tom.Moore@noaa.gov]
Sent: Wednesday, May 12, 2010 1:14 PM
To: Miley, Joyce; Polk, Daniel; Nash, Dylan; Endicott, Troy M
Cc: hahn >> Daniel Hahn; Stephanie Willis; Rooney, Terry C
Subject: Re: DWH - R/V Weatherbird Spill Site Operations 5/14&15

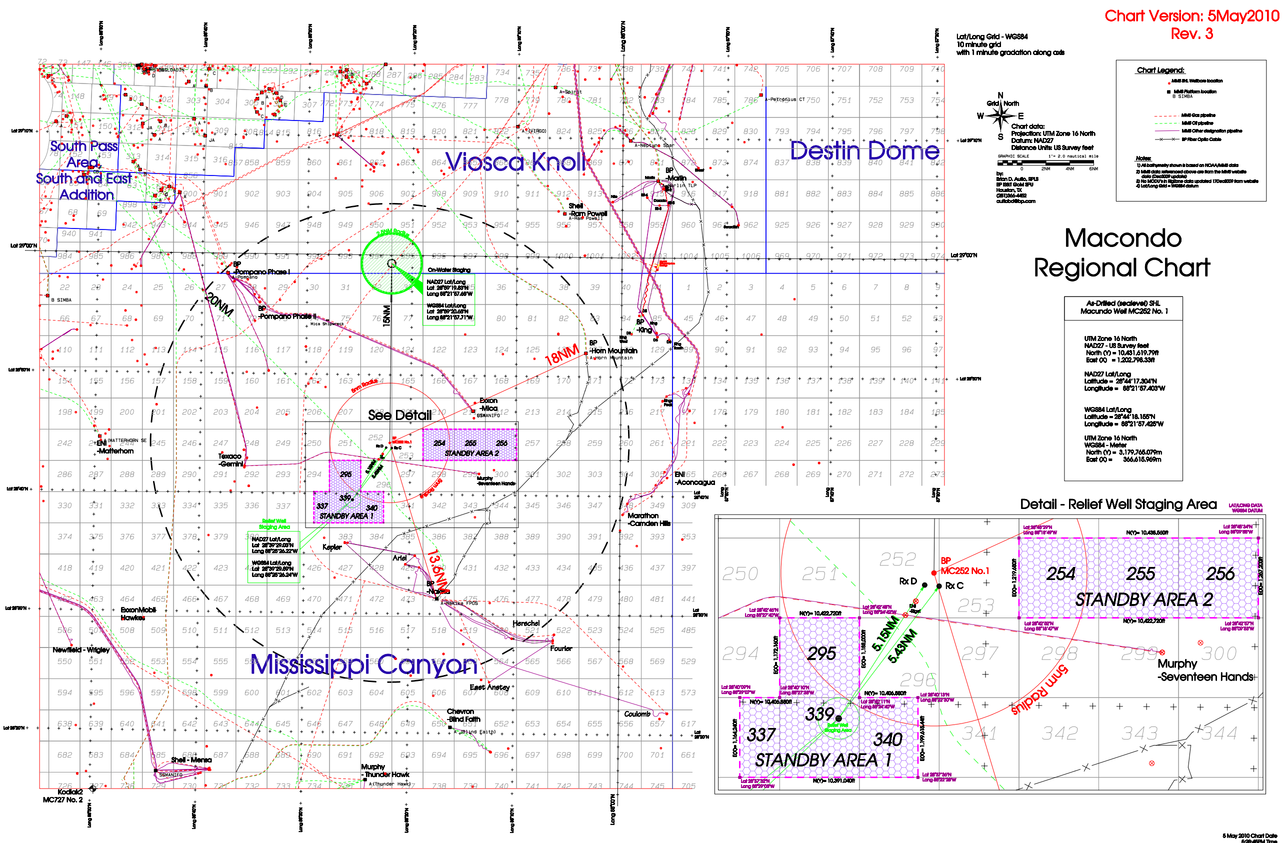
Understand. I will be on both the morning and evening SIMOPS call.

This is the dial-in # in the SIMOPS Plan for 0830 and 2030 calls is that correct:

1- B6 Privacy
Pass Code: B6 Privacy

M.C.252_Inci....pdf (2.6 MB)

Document ID: 0.7.19.240



Begin forwarded message:

From: Nicole Mulanaphy <NMulanaphy@asascience.com>
Date: May 12, 2010 3:47:39 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>
Cc: Debbie French McCay <DFrenchMcCay@asascience.com>
Subject: RE: Today's overflight.

Hi Tom and Dan,

Attached is an image of today's (5/12) fly over by Ocean Imaging. The oil classification at the incident site is displayed.

Thanks!
Nicole

Nicole Whittier Mulanaphy I Environmental Chemical Engineer
Applied Science Associates, Inc.
55 Village Square Drive I South Kingstown, RI 02879 USA
p: +1 401 789-6224 I f: +1 401 789-1932
e: nmulanaphy@asascience.com I www.asascience.com

-----Original Message-----

From: Nicole Mulanaphy
Sent: Wednesday, May 12, 2010 12:50 PM
To: 'Tom Moore'; 'Daniel Hahn'
Cc: Debbie French McCay
Subject: RE: Today's overflight.

Hi Tom and Dan,

Attached are images that display the remote sensing performed by Ocean Imaging for May 10th and May 11th. There is an AM and PM for May 10th. Currently there is only an AM for May 11th, if they did a fly over in the PM they are still processing the data. As soon as it is on the ftp site I will send you an image.

Thanks!
Nicole

Nicole Whittier Mulanaphy l Environmental Chemical Engineer Applied Science Associates, Inc.
55 Village Square Drive l South Kingstown, RI 02879 USA
p: +1 401 789-6224 l f: +1 401 789-1932
e: nmulanaphy@asascience.com l www.asascience.com

-----Original Message-----
From: Nicole Mulanaphy
Sent: Wednesday, May 12, 2010 10:57 AM
To: Tom Moore; Daniel Hahn
Cc: Debbie French McCay
Subject: RE: Today's overflight.

Hi Tom and Dan,

The Ocean Imaging data is on their ftp site. The details are:

[redacted]

On the ftp site are the raster files (for ArcGIS) that contains all of the data, there is information on their flight path and the oil classification (i.e. thickness, emulsion, sheen, ect.). For some of the days there are pdfs. This is what Debbie attached in her previous email. The site currently has data for May 5th through May 11th. I have downloaded all of the data (very large files) and I am processing them into ArcGIS shape files (smaller file size than the raster files). The shape file do not have the fine 2m resolution like the raster files, but the file size is smaller and easier to work with.

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Nicole

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e: nmulanaphy@asascience.com l www.asascience.com

ASA l Science. Services. Solutions.

Consider the environment before printing this email.

-----Original Message-----
From: Debbie French McCay
Sent: Wednesday, May 12, 2010 9:31 AM
To: Tom Moore; Nicole Mulanaphy
Cc: Daniel Hahn
Subject: RE: Today's overflight.

Tom and Dan,
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Nicole,
Please send access info to Tom and Dan, and explain system -- point them at the pdfs.

Thanks
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Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted] B6 Privacy

____

From: Tom Moore [Tom.Moore@noaa.gov]
Sent: Wednesday, May 12, 2010 9:23 AM
To: Debbie French McCay
Cc: Daniel Hahn
Subject: Re: Today's overflight.

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> http://www.ndbc.noaa.gov/station_page.php?station=42916
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> Attached is an Ocean Imaging overflight interpretaions from 0900cdt May 10, the most recent we have. At that time yesterday, the eastward plume was 1.5km = 0.8nmile long. This seems to be the untreated oil coming up. The southward plume is unclear, might be from dispersant-injected oil coming up more slowly and being carried south in deeper waters. These features have been present for a few days now.

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Deb

Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted]

____

From: Daniel Hahn [Daniel.Hahn@noaa.gov]
Sent: Tuesday, May 11, 2010 9:10 PM
To: Tom Moore
Cc: Debbie French McCay
Subject: Re: Today's overflight.

Agreed that is would be good to have dave relay information back to us
the days leading up to our time in the plume.
Dan

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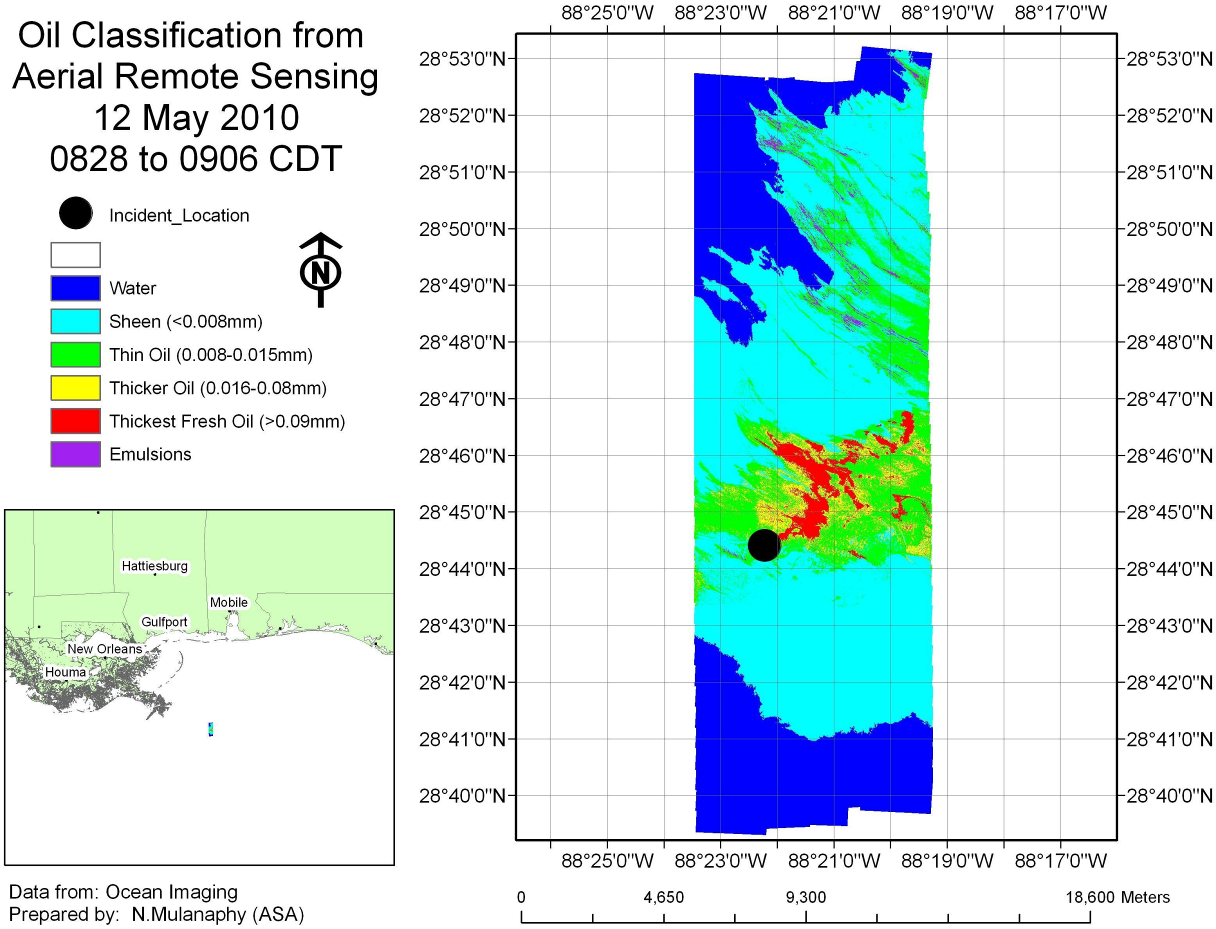
>
> Sent from my iPad

--
Daniel Hahn, Ph.D.
Regional Resource Coordinator
National Oceanic and Atmospheric Administration Assessment &
Restoration Division, SE Region
263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: [redacted]
Fax: [redacted]
Cell: [redacted]<Classification_5-10-10_0900CDT.jpg><2010May12-0130gmt-42916_5day.png>

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

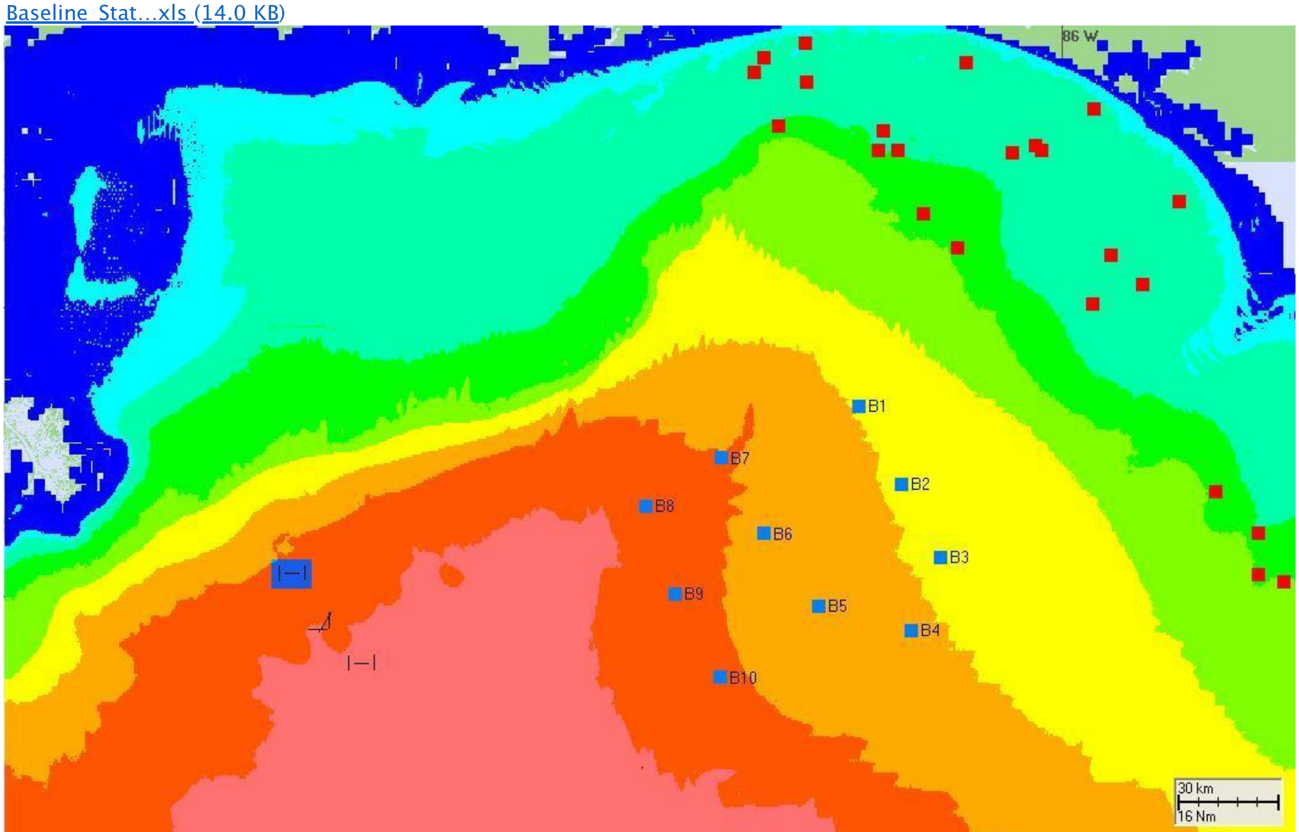
[redacted] Office
[redacted] Cell



Begin forwarded message:

> **From:** RV Weatherbird <dwhnrda.cruise1@gmail.com>
> **Date:** May 12, 2010 12:25:11 PM EDT
> **To:** Tom Moore <Tom.Moore@noaa.gov>
> **Cc:** DFrenchMcCay@asascience.com
> **Subject:** **WBII May 12, 2010**
>
> Hi Tom and Deb,
> Please find attached our new locations for the bravo stations (excel spreadsheet, jpeg, and shape file). We are steaming towards B1 right now. We should be on station in approximately 3-5 hours. We have finished all of the SEAMAP stations, we were slightly delayed last night due to head troubles, but all fixed now. We are figuring around 2 to 2.5 hours of work per bravo station. We tightened up the station locations to be between 13-15NM apart. With transit, we are looking at 4 hours per station (10 stations) starting between 3:30 to 5:30 this evening (working around clock). We are going to hit them in order, ending in B10 and then we start steaming over to the D stations.
>
> We will check this e-mail again after our first station, while in transit to next (B2).
>
> Thanks

Baseline_Stat...xls (14.0 KB)



WBII-2nd_le...1.zip (1.1 KB)

Begin forwarded message:

From: Debbie French McCay <DFrenchMcCay@asascience.com>
Date: May 12, 2010 5:19:06 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>
Cc: Daniel Hahn <Daniel.Hahn@noaa.gov>
Subject: **RE: WBII May 12, 2010**

Tom and Dan,

Do you have info or a contact re what the ops schedule is at the wellhead, such as:

Schedule of containments domes on and off (date/time on and off)
Schedule of dispersant injections: date/time start, stop and gal/min injected

How can we get this information? (Particularly the dispersant injections)

Thanks,

Deb

Deborah French McCay, PhD
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879
(office) [redacted]
(fax) [redacted]
dfrenchmccay@asascience.com or
d.french.mccay@asascience.com

-----Original Message-----
From: Tom Moore [mailto:Tom.Moore@noaa.gov]
Sent: Wednesday, May 12, 2010 4:51 PM
To: RV Weatherbird
Cc: Debbie French McCay
Subject: Re: WBII May 12, 2010

Lets see how the first few stations go and we can see what timing looks like for your spill area arrival. We have you guys plugged into the incident plan for a Friday arrival at 0600, we'll need to make a call tomorrow if it is work skipping a few stations so you can at least get to the spill area sometime mid-day friday. Then maybe you could do some night work or try to do a set of D stations along with the P stations on Saturday. They are installing some new oil capture domes in the next few days as well so assuming they get luckily and block the oil it would be good to get our D and P stations sooner rather then later.

I will be on the spill area coordination call starting tonight so I should have a better sense as to how tight our schedule is going to need to be.

On May 12, 2010, at 12:25 PM, RV Weatherbird wrote:

> Hi Tom and Deb,
> Please find attached our new locations for the bravo stations (excel spreadsheet, jpeg, and shape file). We are steaming towards B1 right now. We should be on station in approximately 3-5 hours. We have finished all of the SEAMAP stations, we were slightly delayed last night due to head troubles, but all fixed now. We are figuring around 2 to 2.5 hours of work per bravo station. We tightened up the station locations to be between 13-15NM apart. With transit, we are looking at 4 hours per station (10 stations) starting between 3:30 to 5:30 this evening (working around clock). We are going to hit them in order, ending in B10 and then we start steaming over to the D stations.
>
> We will check this e-mail again after our first station, while in transit to next (B2).
>
> Thanks
> Mel and Drew

Begin forwarded message:

From: Laurie Sullivan <Laurie.Sullivan@noaa.gov>
Date: May 12, 2010 5:26:00 PM EDT
To: Debbie French McCay <DFrenchMcCay@asascience.com>
Cc: Tom Moore <Tom.Moore@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>
Subject: **Re: WBII May 12, 2010**

Deb, we can ask this of the SSC at our trustee call tomorrow morning, or at tonight's ORR call, or (best) when I see Frank tonight.

Debbie French McCay wrote:

> Tom and Dan,
>
> Do you have info or a contact re what the ops schedule is at the wellhead, such as:
>
> Schedule of containments domes on and off (date/time on and off)
> Schedule of dispersant injections: date/time start, stop and gal/min injected
>
> How can we get this information? (Particularly the dispersant injections)
>
> Thanks,
> Deb
>
> Deborah French McCay, PhD
> Applied Science Associates, Inc. (ASA)
> 55 Village Square Drive
> South Kingstown, RI 02879
> (office) [redacted]
> (fax) [redacted]
> dfrenchmccay@asascience.com or
> d.french.mccay@asascience.com
>
> -----Original Message-----
> From: Tom Moore [mailto:Tom.Moore@noaa.gov] Sent: Wednesday, May 12, 2010 4:51 PM
> To: RV Weatherbird
> Cc: Debbie French McCay
> Subject: Re: WBII May 12, 2010
>
> Lets see how the first few stations go and we can see what timing looks like for your spill area arrival. We have you guys plugged into the incident plan for a Friday arrival at 0600, we'll need to make a call tomorrow if it is work skipping a few stations so you can at least get to the spill area sometime mid-day friday. Then maybe you could do some night work or try to do a set of D stations along with the P stations on Saturday. They are installing some new oil capture domes in the next few days as well so assuming they get luckily and block the oil it would be good to get our D and P stations sooner rather then later.
> I will be on the spill area coordination call starting tonight so I should have a better sense as to how tight our schedule is going to need to be.
>
> On May 12, 2010, at 12:25 PM, RV Weatherbird wrote:
>
>> Hi Tom and Deb,
>> Please find attached our new locations for the bravo stations (excel spreadsheet, jpeg, and shape file). We are steaming towards B1 right now. We should be on station in approximately 3-5 hours. We have finished all of the SEAMAP stations, we were slightly delayed last night due to head troubles, but all fixed now. We are figuring around 2 to 2.5 hours of work per bravo station. We tightened up the station locations to be between 13-15NM apart. With transit, we are looking at 4 hours per station (10 stations) starting between 3:30 to 5:30 this evening (working around clock). We are going to hit them in order, ending in B10 and then we start steaming over to the D stations.
>>
>> We will check this e-mail again after our first station, while in transit to next (B2).
>>
>> Thanks
>> Mel and Drew

--
Laurie Sullivan
Regional Resources Coordinator
NOAA ORR/Assessment and Restoration Division
777 Sonoma Avenue, Ste 219A
Santa Rosa, CA 95404

Office: 707-575-6077
Fax: [redacted] B6 Privacv
Cell: B6 Privacy

Begin forwarded message:

From: Jill Rowe <jrowe@asascience.com>
Date: May 12, 2010 7:53:50 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Cc: "Daniel.Hahn@noaa.gov" <Daniel.Hahn@noaa.gov>, Debbie French McCay <DFrenchMcCay@asascience.com>
Subject: FW: Deepwater Horizon - Dispersants and water column damages

Tom and Dan,

FYI. We just got this from Jan Roletto. I have not been able to review it yet, but will do some either later tonight or tomorrow. Maybe we should discuss this at some point, or as I mentioned earlier, maybe we should make a subgroup for pelagic fish/invert data collection?

Thanks,
Jill

Jill Rowe I Biologist
Applied Science Associates, Inc.
55 Village Square Drive I South Kingstown, RI 02879 USA
p: +1 401 789-6224, ext. 329 I f: +1 401 789-1932
e: jrowe@asascience.com I www.asascience.com

ASA I Science. Services. Solutions.

-----Original Message-----
From: Jan Roletto [mailto:Jan.Roletto@noaa.gov]
Sent: Wednesday, May 12, 2010 7:29 PM
To: Debbie French McCay
Cc: Patrick Rutten; jrpayne@sbcglobal.net; Maria Brown; Lisa Symons; Rob Ricker; Robert A Taylor; Laurie Sullivan; Eileen Graham; Jill Rowe; Melanie Schroeder; Jaime Jahncke; David.Demer@noaa.gov
Subject: Re: Deepwater Horizon - Dispersants and water column damages

Hi Debby:

Attached is an overview of biomass estimates using an EK 60. This was sent to you from one of our research partners Jaime Jahncke from PRBO Conservation Science. Jaime has suggested that Dave Demer from NMFS take a look at the situation and determine if the process of using this biomass assessment, along with ground truthing nets will provide needed data on rapid assessment of water column biomass, possible resources at risk, and fate of dispersants in the ecosystem. I've include Jaime's and Dave's email if you want to contact them directly.

Sorry for the delay, I was working on a shoreline early notification for volunteers, for the spill.

Let me know if you have any other questions. Both Pat and are still very interested in whether or not we can use this type of data and information for NRDA for this spill and in the future.

Best, Jan

On 5/7/10 1:21 PM, Debbie French McCay wrote:

> Jan,
> Please do send your protocols. We are gathering information on what data exists for fish biomass, and what can be done to sample fish distributions. The focus is on developing data to quantify baseline biomass pre-spill (or in reference areas). We are looking at modeling the exposure and injury resulting, and to do this we need to estimate pre-spill biomass.
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> Thanks,
> Debbie
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> Deborah French McCay
> Applied Science Associates, Inc. (ASA)
> 55 Village Square Drive
> South Kingstown, RI 02879 USA
> d.french.mccay@asascience.com
> voc: B6 Privacy
> ____
> From: Jan Roletto [Jan.Roletto@noaa.gov]
> Sent: Friday, May 07, 2010 3:16 PM
> To: Debbie French McCay
> Cc: Patrick Rutten; jrpayne@sbcglobal.net; Maria Brown; Lisa Symons; Rob Ricker; Robert A Taylor; Laurie Sullivan; Eileen Graham; Jennifer Cragan
> Subject: Re: Deepwater Horizon - Dispersants and water column damages
>
> Hi Debbie:
>
> The assessment of biomass using an EK 60 to record biomass is useful but is still relatively new. I can send you protocols from our project if you'd like. We've never used this techniques for rapid response, fate of oil/dispersants or resources at risk. It looks like you are well poised to test this, if you are interested.
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> We have started to use an EK 60, using three frequencies to record water column biomass. In post-processing the biomass can be calculated, but you would also need to ground truth the images by collecting a few trawls. Pat and I are hoping that this type of technique can also be used for rapid assessment, having an individual annotate images on the screen in real time, with "estimates" of denser schools/patches of fish, krill, shrimp, etc.
>
> Best, Jan
>
> On 5/6/10 11:34 AM, Debbie French McCay wrote:
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>> Jan,
>> I am working with Dan Hahn and Tom Moore re a ichthyoplankton sampling cruise with USF scientists that is now sampling on FL shelf but next week will go to the release site area. That plan is still being developed (for the second leg at the release site). Sampling will be in the upper 350m, focused on surface mixed layer to about 40m.
>>
>> Is there a fish finder that can record biomass while underway? I am not familiar with the latest technology re this. Can you give me some info on that? We had no data on pelagic fish biomass out in the release site area.
>>
>> Thanks
>> Debbie

Deborah French McCay, PhD
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879
(office) [redacted]
(fax) [redacted]
dfrenchmccay@asascience.com or
d.french.mccay@asascience.com

-----Original Message-----
From: Jan Roletto [mailto:Jan.Roletto@noaa.gov]
Sent: Thursday, May 06, 2010 2:03 PM
To: Debbie French McCay
Cc: Patrick Rutten; jrpayne@sbcglobal.net; Maria Brown; Lisa Symons; Rob Ricker; Robert A Taylor; Laurie Sullivan; Eileen Graham; Jennifer Cragan
Subject: Re: Deepwater Horizon - Dispersants and water column damages

Hi Debbie:

Sounds great. Good to hear you're on it!

Is it possible that the vessel has a recordable fish finder, if not an ER or EK 60, for recoding underway water column biomass? If not, is it possible to have a second vessel follow the same track line, within 12 hours of the initial vessel, with some type of recordable fish finder or EK 60?

Best, Jan

On 5/6/10 10:43 AM, Debbie French McCay wrote:

> Jan and Pat,
>
> The Water Column TWG has a cruise leaving the dock at 1800 CDT today to go out and get water samples in the vicinity and in the rising oil plume. We are doing CTDs, THC, PAHs BTEX, fluorescence in upper 50m, oil droplet sizes. Measuring currents upper 50m. Also have ROV to sample bottom water.
>
> We can coordinate via the TWG head Laurie Sullivan, cc'd here. There is a completed cruise plan. Jim Payne is on the cruise, assisted by an ASA person (Eileen Graham). Another ASA person Jennifer Cragan is in the command center with Laurie.
>
> Debbie
>
> Deborah French McCay, PhD
> Applied Science Associates, Inc. (ASA)
> 55 Village Square Drive
> South Kingstown, RI 02879
> (office) [redacted]
> (fax) [redacted]
> dfrenchmccay@asascience.com or
> d.french.mccay@asascience.com
>
> -----Original Message-----
> From: Jan Roletto [mailto:Jan.Roletto@noaa.gov]
> Sent: Thursday, May 06, 2010 1:11 PM
> To: Patrick Rutten; Debbie French McCay; jrpayne@sbcglobal.net

Using EK60 ...ocx (29.2 KB)
Begin forwarded message:

> **From:** Tom Moore <Tom.Moore@noaa.gov>
> **Date:** May 12, 2010 8:29:13 PM EDT
> **To:** Ernst Peebles <epeebles@marine.usf.edu>
> **Subject:** **Fwd: WBII May 12, 2010**
>
> FYI... Looks like things are going well, though I think we will drop the B4 station and maybe more if needed. Right now I am still hopeful they can make the spill zone Friday which is when we are on the ops plan and they are clearing some areas for us.
>
> Begin forwarded message:
>
>> **From:** RV Weatherbird <dwhnrda.cruise1@gmail.com>
>> **Date:** May 12, 2010 4:25:11 PM EDT
>> **To:** Tom Moore <Tom.Moore@noaa.gov>
>> **Cc:** DFrenchMcCay@asascience.com
>> **Subject:** **WBII May 12, 2010**
>>
>> Hi Tom and Deb,
>> Please find attached our new locations for the bravo stations (excel spreadsheet, jpeg, and shape file). We are steaming towards B1 right now. We should be on station in approximately 3-5 hours. We have finished all of the SEAMAP stations, we were slightly delayed last night due to head troubles, but all fixed now. We are figuring around 2 to 2.5 hours of work per bravo station. We tightened up the station locations to be between 13-15NM apart. With transit, we are looking at 4 hours per station (10 stations) starting between 3:30 to 5:30 this evening (working around clock). We are going to hit them in order, ending in B10 and then we start steaming over to the D stations.
>>
>> We will check this e-mail again after our first station, while in transit to next (B2).
>>
>> Thanks
>> Mel and Drew
>>
>> On 5/12/10, Tom Moore <Tom.Moore@noaa.gov> wrote:
>>> Melanie should be able to help interpret this information... Were using this info to target final spill area sampling. 1 jpg, and 2 ZIP files attached.
>>>
>>>> Laurie, Rob, Troy,
>>>> See also attached Ocean Imaging interpretations of remote sensing with oil thickness. Fresh thick oil should be surfacing oil.
>>>> Deb
>>>>
>>>> Laurie, Dan, Tom,
>>>>
>>>> Attached are my model results for 5AM today using the measured currents at the wellhead (ADCP). The Payne cruise should be sampling where oil is coming up and in the surface waters, but note the narrow plume. The 100

deg 8km out position is where I placed him last night, and he reported they were at P1 position at 8am running the ROV. The plan is they go from P1 toward P4. If you look at the pictures, I think the deep plume at the bottom is close to the wellhead and just SW, but also at P3 (between P2 and P4). You can see this is a tough thing to sample. This is why I think we need more sampling out there. The Sipper sampling will be a big help.

I have been discussing the deep plume modeling with CJ Beegle-Krause, who is lead on that for the response. OK that we share model predictions? I can cc Robert and Stephanie on any emailed pictures, but will keep discussions on the phone.

Thanks,
Deb

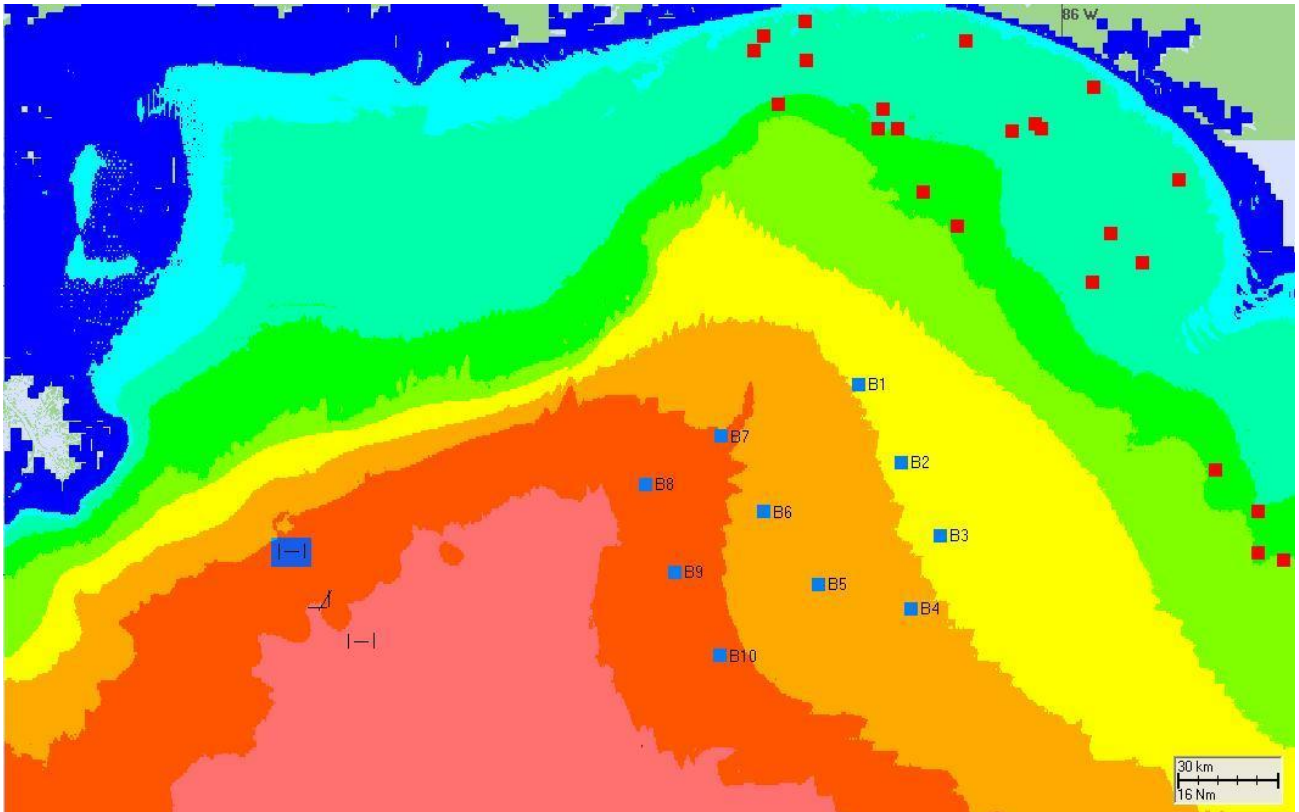
The Payne cruise is going to sample the rising plume tomorrow am and all indications I can find show that the rising plume extends to the east. The ADCP shows eastward currents in the surface layer (to 100 deg. about 0.7 kts), and the currents 100-300m down are ~0.2 kts to NE. Net seems to be about due east. See vector plot attached. This is at:
http://www.ndbc.noaa.gov/station_page.php?station=42916

Attached is an Ocean Imaging overflight interpretaions from 0900cdt May 10, the most recent we have. At that time yesterday, the eastward plume was 1.5km = 0.8nmile long. This seems to be the untreated oil coming up. The southward plume is unclear, might be from dispersant-injected oil coming up more slowly and being carried south in deeper waters. These features have been present for a few days now.

We'd like the Sipper to sample both these plumes. Ocean Imaging should be up flying again soon (was not today), so we should get more by the 14th.

Deb

Baseline_Stat...xls (14.0 KB)



[WBII-2nd_le...1.zip (1.1 KB)]

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
B6 Privacy Cell

Begin forwarded message:

From: Jill Rowe <jrowe@asascience.com>
Date: May 12, 2010 8:50:06 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>, "Daniel.Hahn@noaa.gov" <Daniel.Hahn@noaa.gov>
Cc: Debbie French McCay <DFrenchMcCay@asascience.com>
Subject: **FW: Deepwater Horizon - Dispersants and water column damages**

Tom and Dan,

More FYI for pelagic fish sampling. I will follow up with the folks David mentions below tomorrow, unless you would like to do that, Tom?

Thanks,

Jill

Jill Rowe | Biologist
Applied Science Associates, Inc.
55 Village Square Drive | South Kingstown, RI 02879 USA
p: +1 401 789-6224, ext. 329 | f: +1 401 789-1932
e: jrowe@asascience.com | www.asascience.com

ASA | Science. Services. Solutions.

-----Original Message-----
From: David Demer [mailto:David.Demer@noaa.gov]
Sent: Wednesday, May 12, 2010 8:41 PM
To: Jan.Roletto@noaa.gov
Cc: Debbie French McCay; Patrick Rutten; jrpayne@sbcglobal.net; Maria Brown; Lisa Symons; Rob Ricker; Robert A Taylor; Laurie Sullivan; Eileen Graham; Jill Rowe; Melanie Schroeder; Jaime Jahncke; Thompson, Charles H. ; Christopher T Gledhill
Subject: Re: Deepwater Horizon - Dispersants and water column damages

Hello,

The use of multi-frequency scientific echosounders, such as the Simrad EK60 (and the ME70 on the new NOAA FSVs), coupled with net or optical sampling, is a mature method for surveying the distributions and estimating abundances of fish and zooplankton. I have personally used acoustic-trawl or acoustic-optical sampling for surveying krill and fish (demersal, mid-water, and epi-pelagic), during the last ca. 20 years, but acoustic-trawl surveys have been used around the world for at least 40 years. That is, mature technologies and methods are available for post-spill monitoring. The bigger question is -- what pre-spill data is available to estimate baseline biomasses in the area, by species? I suggest contacting Charles Thompson and Chris Gledhill at the NMFS Southeast Fisheries Science Center (I've cc'd them so they know who to blame for this introduction). They are both very knowledgeable about acoustic-trawl surveys, and I expect they know, or know who knows, about historical survey data in the area.

Sincerely,

David Demer

Jan Roletto wrote:

> Hi Debby:
>
> Attached is an overview of biomass estimates using an EK 60. This was sent to you from one of our research partners Jaime Jahncke from PRBO Conservation Science. Jaime has suggested that Dave Demer from NMFS take a look at the situation and determine if the process of using this biomass assessment, along with ground truthing nets will provide needed data on rapid assessment of water column biomass, possible resources at risk, and fate of dispersants in the ecosystem. I've include Jaime's and Dave's email if you want to contact them directly.
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voc: B6 Privacy

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Sent: Thursday, May 06, 2010 2:03 PM
To: Debbie French McCay
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Subject: Re: Deepwater Horizon - Dispersants and water column damages

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To: Patrick Rutten; Debbie French McCay; jrpayne@sbcglobal.net
Cc: Maria Brown; Lisa Symons; Rob Ricker
Subject: Deepwater Horizon - Dispersants and water column damages

Hi Pat:

On another NRDA issue, since they are now using dispersants to break up the spill, is there anyone on scene that is conducting baseline water column resources assessment? Jim Payne and I spoke a while ago at an OSPR SSEP meeting, about testing monitoring techniques to assess water column resources, biomass estimates, depth of thermoclines, all to help determine fate of dispersed oil in the food chain (e.g. possibly fish, bird and baleen whale injuries).

Jim and Debby French-McCay had received some funds a few years ago from OSPR to start to test some of the water column assessment techniques for fate of dispersants. We had spoke about using this technique for NRDA, using CTD data and EK 60 data to estimate water column biomass and aerial surveys for resources at risk. Any interest in pursuing this effort for Deepwater Horizon?

If there is interest in pursuing this new level of NRDA efforts I'd be happy to work with Jim and Debby on this effort. Perhaps, hopefully, one of them are already on scene?

Best, Jan

On 5/5/10 8:16 PM, Patrick Rutten wrote:

> ALL:
> I expect you have already provided this information,.... but I was contacted by Rob Ricker, NOS, ARD who is leading the damage assessment for NOS on the Deepwater Horizon spill, to help identify who would have expertise on turtle and marine mammal necropsy, if needed.
>
> Ideally, the biologist or DVM would be experienced in what specific tests to run, or what physical observations to make in a necropsy that would indicate oil exposure, or signs of ingestion or aspiration. According to Rob the best situation would be to have the biologist onsite in the Gulf to establish a natural resource damage assessment protocol...field to lab. Specific facility for processing animals hasn't been identified, could be Louisiana, could be Florida. As an FYI the 30+ sea turtles that recently washed up were likely the result of fishermen not installing TED's on their nets (a nice black eye!).
>
> All expenses are covered. Just need to know who's is available and qualified.
>
> *Usha - You'd know who at La Jolla and NMML would fit the quals for mammals and turtles Sam / Mike - I know PIFSC has some real turtle pro's Barb - I'm sure you know who in the SE would be capable and could also suggest facilities Maria/Jan - I'm including you since the DVM at the Marine Mammal Center may (may not) be a likely candidate to ask, but I don't have his name.
> *
> As with everything associated with this spill, I need a quick response please. A negative response would be appreciated.
> Thanks,
> Patrick

david_demer.vcf (0.4 KB)
Begin forwarded message:

From: Ernst Peebles <epeebles@marine.usf.edu>
Date: May 12, 2010 9:10:15 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Subject: **Re: Fwd: WBII May 12, 2010**

Sounds good, Tom - I have some potential activities to run by you when you have time. I will be in a meeting all morning tomorrow (Thurs), but will need to discuss potential media coverage and oil-sample disposition with you tomorrow afternoon. I will call to discuss - please let me know if some times are better than others tomorrow afternoon. Ernst

At 08:29 PM 5/12/2010, you wrote:

FYI... Looks like things are going well, though I think we will drop the B4 station and maybe more if needed. Right now I am still hopeful they can make the spill zone Friday which is when we are on the ops plan and they are clearing some areas for us.

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>>> Laurie, Rob, Troy,
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>>> Laurie, Dan, Tom,
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>>> 10, the most recent we have. At that time yesterday, the eastward plume
>>> was 1.5km = 0.8nmile long. This seems to be the untreated oil coming up.
>>> The southward plume is unclear, might be from dispersant-injected oil
>>> coming up more slowly and being carried south in deeper waters. These
>>> features have been present for a few days now.
>>>
>>> We'd like the Sipper to sample both these plumes. Ocean Imaging should be
>>> up flying again soon (was not today), so we should get more by the 14th.
>>>
>>> Deb
>>
>>>
>>>
>>
>>
>>
>>
>>
>>
>>
>>

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

FYI... Looks like things are going well, though I think we will drop the B4 station and maybe more if needed. Right now I am still hopeful they can make the spill zone Friday which is when we are on the ops plan and they are clearing some areas for us.

Begin forwarded message:

> **From:** RV Weatherbird < dwhnrda.cruise1@gmail.com>
> **Date:** May 12, 2010 4:25:11 PM EDT
> **To:** Tom Moore <Tom.Moore@noaa.gov>
> **Cc:** DFrenchMcCay@asascience.com
> **Subject: WBII May 12, 2010**
>
> Hi Tom and Deb,
> Please find attached our new locations for the bravo stations (excel spreadsheet, jpeg, and shape file). We are steaming towards B1 right now. We should be on station in approximately 3-5 hours. We have finished all of the SEAMAP stations, we were slightly delayed last night due to head troubles, but all fixed now. We are figuring around 2 to 2.5 hours of work per bravo station. We tightened up the station locations to be between 13-15NM apart. With transit, we are looking at 4 hours per station (10 stations) starting between 3:30 to 5:30 this evening (working around clock). We are going to hit them in order, ending in B10 and then we start steaming over to the D stations.
>
> We will check this e-mail again after our first station, while in transit to next (B2).
>
> Thanks
> Mel and Drew
>
> On 5/12/10, Tom Moore <Tom.Moore@noaa.gov> wrote:
>
> > Melanie should be able to help interpret this information... Were using this info to target final spill area sampling. 1 jpg, and 2 ZIP files attached.
> >
> > > Laurie, Rob, Troy,
> > > See also attached Ocean Imaging interpretations of remote sensing with oil thickness. Fresh thick oil should be surfacing oil.
> > > Deb
> > >
> > > Laurie, Dan, Tom,
> > >
> > > Attached are my model results for 5AM today using the measured currents at the wellhead (ADCP). The Payne cruise should be sampling where oil is coming up and in the surface waters, but note the narrow plume. The 100 deg 8km out position is where I placed him last night, and he reported they were at P1 position at 8am running the ROV. The plan is they go from P1 toward P4. If you look at the pictures, I think the deep plume at the bottom is close to the wellhead and just SW, but also at P3 (between P2 and P4). You can see this is a tough thing to sample. This is why I think we need more sampling out there. The Sipper sampling will be a big help.

I have been discussing the deep plume modeling with CJ Beegle-Krause, who is lead on that for the response. OK that we share model predictions? I can cc Robert and Stephanie on any emailed pictures, but will keep discussions on the phone.

Thanks,
Deb

The Payne cruise is going to sample the rising plume tomorrow am and all indications I can find show that the rising plume extends to the east.
The ADCP shows eastward currents in the surface layer (to 100 deg. about 0.7 kts), and the currents 100-300m down are ~0.2 kts to NE. Net seems to be about due east. See vector plot attached. This is at:
http://www.ndbc.noaa.gov/station_page.php?station=42916

Attached is an Ocean Imaging overflight interpretaions from 0900cdt May 10, the most recent we have. At that time yesterday, the eastward plume was 1.5km = 0.8nmile long. This seems to be the untreated oil coming up. The southward plume is unclear, might be from dispersant-injected oil coming up more slowly and being carried south in deeper waters. These features have been present for a few days now.

We'd like the Sipper to sample both these plumes. Ocean Imaging should be up flying again soon (was not today), so we should get more by the 14th.

Deb

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
B6 Privacy [redacted] Cell

Begin forwarded message:

From: Daniel Hahn <Daniel.Hahn@noaa.gov>

Date: May 12, 2010 9:50:30 PM EDT
To: Laurie Sullivan <Laurie.Sullivan@noaa.gov>
Cc: Debbie French McCay <DFrenchMcCay@asascience.com>, Tom Moore <Tom.Moore@noaa.gov>
Subject: **Re: WBII May 12, 2010**

Thanks for tracking this down Laurie. One of the benefits of being at the ICP. Hopefully Frank has, or can track down that information. It seemed difficult to get the information on deep disspersant injection volumes. Timing of injections should be much more straight forward. Also, isn't the new-style dome a while out still? My impression wasn't that it was in the next few days.

Dan

Laurie Sullivan wrote:

> Deb, we can ask this of the SSC at our trustee call tomorrow morning, or at tonight's ORR call, or (best) when I see Frank tonight.
>
> Debbie French McCay wrote:
>
> > Tom and Dan,
> >
> > Do you have info or a contact re what the ops schedule is at the wellhead, such as:
> >
> > Schedule of containments domes on and off (date/time on and off)
> > Schedule of dispersant injections: date/time start, stop and gal/min injected
> >
> > How can we get this information? (Particularly the dispersant injections)
> >
> > Thanks,
> > Deb
> >
> > Deborah French McCay, PhD
> > Applied Science Associates, Inc. (ASA)
> > 55 Village Square Drive
> > South Kingstown, RI 02879
> > (office) 401-789-6224
> > (fax) [redacted]
> > dfrenchmccay@asascience.com or
> > d.french.mccay@asascience.com
> >
> > -----Original Message-----
> > From: Tom Moore [mailto:Tom.Moore@noaa.gov] Sent: Wednesday, May 12, 2010 4:51 PM
> > To: RV Weatherbird
> > Cc: Debbie French McCay
> > Subject: Re: WBII May 12, 2010
> >
> > Lets see how the first few stations go and we can see what timing looks like for your spill area arrival. We have you guys plugged into the incident plan for a Friday arrival at 0600, we'll need to make a call tomorrow if it is work skipping a few stations so you can at least get to the spill area sometime mid-day friday. Then maybe you could do some night work or try to do a set of D stations along with the P stations on Saturday. They are installing some new oil capture domes in the next few days as well so assuming they get luckily and block the oil it would be good to get our D and P stations sooner rather then later. I will be on the spill area coordination call starting tonight so I should have a better sense as to how tight our schedule is going to need to be.
> >
> > On May 12, 2010, at 12:25 PM, RV Weatherbird wrote:
> >
> > > Hi Tom and Deb,
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> > > > finished all of the SEAMAP stations, we were slightly delayed last night due to head troubles, but all fixed now. We are figuring around 2 to 2.5 hours of work per bravo station. We tightened up the station locations to be between 13-15NM apart. With transit, we are looking at 4 hours per station (10 stations) starting between 3:30 to 5:30 this evening (working around clock). We are going to hit them in order, ending in B10 and then we start steaming over to the D stations.
> > > >
> > > > We will check this e-mail again after our first station, while in transit to next (B2).
> > > >
> > > > Thanks
> > > > Mel and Drew
>
> --
> Daniel Hahn, Ph.D.
> Regional Resource Coordinator
> National Oceanic and Atmospheric Administration
> Assessment & Restoration Division, SE Region
> 263 13th Avenue South
> St. Petersburg, FL 33701
>
> email: Daniel.Hahn@noaa.gov
> Phone: (727) 551-5715
> Fax: [redacted] B6 Privacy
> Cell: [redacted] B6 Privacy

Begin forwarded message:

> **From:** Laurie Sullivan <Laurie.Sullivan@noaa.gov>
> **Date:** May 12, 2010 10:00:38 PM EDT
> **To:** Daniel Hahn <Daniel.Hahn@noaa.gov>
> **Cc:** Debbie French McCay <DFrenchMcCay@asascience.com>, Tom Moore <Tom.Moore@noaa.gov>
> **Subject:** **Re: WBII May 12, 2010**
>
> My understanding of the situation is that this method is their second choice and is not happening in the next few days.
>
> Daniel Hahn wrote:
> > Thanks for tracking this down Laurie. One of the benefits of being at the ICP. Hopefully Frank has, or can track down that information. It seemed difficult to get the information on deep disspersant injection volumes. Timing of injections should be much more straight forward. Also, isn't the new-style dome a while out still? My impression wasn't that it was in the next few days.
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> > Laurie Sullivan wrote:
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> > > > Tom and Dan,
> > > >
> > > > Do you have info or a contact re what the ops schedule is at the wellhead, such as:

Schedule of containments domes on and off (date/time on and off)
Schedule of dispersant injections: date/time start, stop and gal/min injected

How can we get this information? (Particularly the dispersant injections)

Thanks,
Deb

Deborah French McCay, PhD
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879
(office) [redacted]
(fax) [redacted]
dfrenchmccay@asascience.com or
d.french.mccay@asascience.com

-----Original Message-----
From: Tom Moore [mailto:Tom.Moore@noaa.gov] Sent: Wednesday, May 12, 2010 4:51 PM
To: RV Weatherbird
Cc: Debbie French McCay
Subject: Re: WBII May 12, 2010

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> We will check this e-mail again after our first station, while in transit to next (B2).
>
> Thanks
> Mel and Drew

--
Laurie Sullivan
Regional Resources Coordinator
NOAA ORR/Assessment and Restoration Division
777 Sonoma Avenue, Ste 219A
Santa Rosa, CA 95404

Office: 707-575-6077
Fax: 707-575-6094
Cell: [redacted] B6 Privacy

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 13, 2010 8:58:39 AM EDT
To: Laurie Sullivan <Laurie.Sullivan@noaa.gov>
Cc: Daniel Hahn <Daniel.Hahn@noaa.gov>, Debbie French McCay <DFrenchMcCay@asascience.com>
Subject: **Re: WBII May 12, 2010**

I don't know.... I was on the SIMOPS call last night (in prep for the Weatherbird's site arrival) and one of the vessels mentioned that they expected to receive authorization for subsea dispersant use in the next 12 hours, folks in Houston corrected him and told him it might be this morning. As for the "top hat" the SIMOPS folks said it was on the bottom (but not over the leak) and the the drill ship was in the process of lowering piping. They have third drill rig arriving today for relief well work. I'll be on the morning SIMOPS call today and should be able to get a few more details.

On May 12, 2010, at 10:00 PM, Laurie Sullivan wrote:

> My understanding of the situation is that this method is their second choice and is not happening in the next few days.
>
> Daniel Hahn wrote:
>
>> Thanks for tracking this down Laurie. One of the benefits of being at the ICP. Hopefully Frank has, or can track down that information. It seemed difficult to get the information on deep disspersant injection volumes. Timing of injections should be much more straight forward. Also, isn't the new-style dome a while out still? My impression wasn't that it was in the next few days.
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South Kingstown, RI 02879
(office) [redacted]
(fax) [redacted]
dfrenchmccay@asascience.com or
d.french.mccay@asascience.com

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Cc: Debbie French McCay
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--
Laurie Sullivan
Regional Resources Coordinator
NOAA ORR/Assessment and Restoration Division
777 Sonoma Avenue, Ste 219A
Santa Rosa, CA 95404

Office: 707-575-6077

Fax: B6 Privacy
Cell: B6 Privacy

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
B6 Privacy Cell

Begin forwarded message:

From: Richard Snyder <rsnyder@uwf.edu>
Date: May 13, 2010 10:07:43 AM EDT
To: Ernst Peebles <epeebles@marine.usf.edu>
Cc: "Hogarth, Bill" <billhogarth@usf.edu>, Ted.Switzer@myfwc.com, Tom.Moore@noaa.gov, Daniel Hahn <Daniel.Hahn@noaa.gov>, Bob.McMichael@fwc.state.fl.us, Arthur Jonathan <Jonathan.Arthur@dep.state.fl.us>, berry@fau.edu, drumbold@fgcu.edu, Ellington William Ross <WEllington@admin.fsu.edu>, "George A. Maul" <gmaul@fit.edu>, Felicia Coleman <coleman@bio.fsu.edu>, heithaus@fiu.edu, Jennifer.cherrier@famu.edu, morris@ncf.edu, portner@rsmas.miami.edu, pwelsh@unf.edu, gwhite@ju.edu, radha.pyati@unf.edu, rcowen@rsmas.miami.edu, "Richard E. Dodge" <dodge@nova.edu>, rpodemski@uwf.edu, shagen@mail.ucf.edu, sjaishan@ufl.edu, Aswani Volety <avolety@fgcu.edu>, Bill Hogarth <bill.hogarth@admin.usf.edu>, Donald Winter <dwinter@harris.com>, Eric Chassignet <echassignet@coaps.fsu.edu>, Graham Worthy <gworthy@mail.ucf.edu>, Ian Macdonald <imacdonald@fsu.edu>, Joseph Boyer <boyerj@fiu.edu>, Kumar Mahadevan <kumar@mote.org>, Manhar Dhanak <dhanak@fau.edu>, Michael Wade Kindel <mkindel1@fau.edu>, Mitchell Roffer <roffers@bellsouth.net>, Nick Shay <nshay@rsmas.miami.edu>, Peter Braza <pbraza@unf.edu>, Peter Sheng <pete@coastal.ufl.edu>, Peter Tatro <ptatro@hboi.edu>, Sandra Vargo <svargo@marine.usf.edu>, Steve Woll <swoll@weatherflow.com>, William Dewar <dewar@ocean.fsu.edu>, Wade Jeffrey <wjeffrey@uwf.edu>
Subject: Re: North Gulf Shelf Sampling

Ernst:

I do have some concerns, and your rationale to not sample region 10 because it has been "compromised" I do not understand. I waited till this morning to reply hoping the temptation to use language better suited to the pitching deck of a ship in rough weather would subside. I wish I could tell you that is the case.

Region 10 is in the most immediate danger in all of Florida, which at least you acknowledge. I do not understand the rationale to discard the rest of the region because the SW corner may have been impacted. I would think, but then I'm just a low rate scientist in the west of Florida, that fact alone would have created an urgency to get over here and sample region 10 first. The ship sampled East region 8 first, then to the West? What? While we have a window with SE winds keeping the plume away?

You state this is not an "official SEAMAP cruise" and you sampled only 24 of the stations, so adherence to a probablistic sampling scheme (is that what happened?) requiring you discard the most at risk region of the Florida Shelf because of a probability of randomly picking the two stations in the SW corner (?) in the face of a potential ecological catastrophe, seems like exactly the kind of <deleted> decision that causes general public to shake their heads in disgust at their tax dollar paid public servants and the decisions made for the application of tax payer resources, State and Federal.

Can you honestly tell me that if region 5, the middle grounds and Tampa/St. Pete, was in the same situation as we are facing in region 10, that the same decisions would have been made? I'm sure the people up here in the Panhandle will be comforted to know you are prepared to station a ship in the Florida straits for the remote chance significant concentrations of petroleum and/or dispersants will reach there (yes I understand the loop current) when we are facing a more real probability of oil impact here in region 10, offshore and on shore.

No, I do not understand.

The e-mail addressees are members of the FLCOOS and Oil Spill Academic Task Force for their information only, no implied

consent or agreement with my position.

On Wed, May 12, 2010 at 5:58 PM, Ernst Peebles <epeebles@marine.usf.edu> wrote:

> Richard,
>
> Our (FWRI and USF) first priority was to establish pre-impact conditions within those Florida continental-shelf waters that appeared to be most likely to be affected by the spill. At the time of cruise-plan development, panhandle waters appeared to be the most vulnerable. The overall plan was to repeat this approach as necessary in other regions of the West Florida Shelf, positioning future cruises ahead of the spill as it moved east and south. At this point, we do not have funding for additional cruises of this type, and we are watching spill interactions with the Loop Current. Should the oil spill become entrained in the Loop Current, we may be able to position another vessel within the Florida Straits to intercept the oil for chemical fingerprinting.
>
> Early NOAA spill maps indicated oil was present in the southwest corner of NMFS stat zone 10, and 2 of our 11 SEAMAP-style stations were within this area of stat zone 10 (note the term "SEAMAP-style" - our ongoing cruise is not an official SEAMAP cruise). We were therefore concerned that stat zone 10 had been compromised or that it could be argued that it had been compromised. We decided to prioritize stat zones 8 and 9, working west towards the spill. By using SEAMAP protocols to identify stations, we could assure that these stations would be revisited during at least one future SEAMAP cruise that had already been scheduled for July, 2010.
>
> NOAA's first priority was to study the spill site outside Florida waters. In order to stay on schedule for the NOAA work, we had to reduce the number of SEAMAP-style stations from 32 to 24. After departing Pensacola and ending the SEAMAP-style work, the WBII headed toward the spill area. I am still awaiting today's update via satellite phone. It is my understanding that no SEAMAP-style work was done in stat zone 10, although I will check to see what, if anything, was done there during transit to the spill area.
>
> The Pensacola port call was scheduled after the WBII had left St. Pete. It's purpose was 1) to deliver age-sensitive water and sediment samples to shore for shipment to the lab in Texas, and 2) to exchange crew and load new equipment and supplies. At the time of scheduling this port call, the WBII had a full complement of scientific and ship's crew. There is presently no plan to make another port call to Pensacola.
>
> Thanks very much for the offer of support, and please let me know if any of this is not clear or if you have additional concerns.
>
> Regards,
> Ernst
>
> At 01:54 PM 5/12/2010, you wrote:
>
>> I really don't like being a pain in the rear, but I am confused, please help.
>> The Weatherbird cruise plan has stations prioritized for Zones 8 & 9, but for Zone 10:
>>
>> "Figure 6. Locations of SEAMAP sampling stations within NMFS statistical zone 10. At present we do not anticipate sampling within NMFS statistical zone 10 unless sampling within NMFS statistical zones 8 and 9 are completed ahead of schedule."
>>
>> Can someone explain to me why Zone 10, off of Pensacola, Santa Rosa Island, and Perdido Key, likely the first place the oil will come, is not a priority over stations to the east? Did stations around the corner north and east of Cape San Blas get priority over zone 10?
>>
>> 1) how was the sampling for pre-oil condition prioritized? Why is zone 10 a secondary consideration?
>> 2) did they have time to do any sampling in zone 10? Our local paper stated they collect "a" water sample 16 miles south of Pensacola...
>> 3) was the stop in Pensacola yesterday (tuesday) scheduled?
>> 4) will they stop back here before heading to FIO? Anything they need?
>>
>> People here at the likely point of first Florida impact keep asking me what the state is doing to look after their interests.
>> I'm hoping that I'm missing something.
>>
>> --
>> Richard A. Snyder, Ph.D.
>>
>> Professor and Director

Center for Environmental Diagnostics and Bioremediation (CEDB)
http://uwf.edu/cedb/

University of West Florida TEL: (850) 474-2806
11000 University Parkway FAX: -3130
Pensacola, FL 32514 http://uwf.edu/rsnyder/

____

Ernst Peebles, Ph.D.
Associate Professor
College of Marine Science
University of South Florida
140 Seventh Avenue South
St. Petersburg, Florida 33701-5016

office phone: (727) 553-3983
lab phone: [redacted]
fax: [redacted]

____

--
Richard A. Snyder, Ph.D.

Professor and Director
Center for Environmental Diagnostics and Bioremediation (CEDB)
http://uwf.edu/cedb/

University of West Florida TEL: (850) 474-2806
11000 University Parkway FAX: -3130
Pensacola, FL 32514 http://uwf.edu/rsnyder/

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 13, 2010 10:16:40 AM EDT
To: Stephanie Willis <Stephanie.Willis@noaa.gov>, "hahn >> Daniel Hahn" <Daniel.Hahn@noaa.gov>
Subject: Fwd: North Gulf Shelf Sampling

FYI... this is really a State of FL / FWC issue since they controlled all of the decision making with the where they were doing SEAMAP work. Wanted you to make you aware eitherway since our name could get dragged into this.

Begin forwarded message:

From: Richard Snyder <rsnyder@uwf.edu>
Date: May 13, 2010 10:07:43 AM EDT
To: Ernst Peebles <epeebles@marine.usf.edu>
Cc: "Hogarth, Bill" <billhogarth@usf.edu>, Ted.Switzer@myfwc.com, Tom.Moore@noaa.gov, Daniel Hahn <Daniel.Hahn@noaa.gov>, Bob.McMichael@fwc.state.fl.us, Arthur Jonathan <Jonathan.Arthur@dep.state.fl.us>, berry@fau.edu, drumbold@fgcu.edu, Ellington William Ross <WEllington@admin.fsu.edu>, "George A. Maul" <gmaul@fit.edu>, Felicia Coleman <coleman@bio.fsu.edu>, heithaus@fiu.edu, Jennifer.cherrier@famu.edu, morris@ncf.edu, portner@rsmas.miami.edu, pwelsh@unf.edu, gwhite@ju.edu, radha.pyati@unf.edu, rcowen@rsmas.miami.edu, "Richard E. Dodge" <dodge@nova.edu>, rpodemski@uwf.edu, shagen@mail.ucf.edu, sjaishan@ufl.edu, Aswani Volety <avolety@fgcu.edu>, Bill Hogarth <bill.hogarth@admin.usf.edu>, Donald Winter <dwinter@harris.com>, Eric Chassignet <echassignet@coaps.fsu.edu>, Graham Worthy <gworthy@mail.ucf.edu>, Ian Macdonald <imacdonald@fsu.edu>, Joseph Boyer <boyerj@fiu.edu>, Kumar Mahadevan <kumar@mote.org>, Manhar Dhanak <dhanak@fau.edu>, Michael Wade Kindel <mkindel1@fau.edu>, Mitchell Roffer <roffers@bellsouth.net>, Nick Shay <nshay@rsmas.miami.edu>, Peter Braza <pbraza@unf.edu>, Peter Sheng <pete@coastal.ufl.edu>, Peter Tatro <ptatro@hboi.edu>, Sandra Vargo

<svargo@marine.usf.edu>, Steve Woll <swoll@weatherflow.com>, William Dewar <dewar@ocean.fsu.edu>, Wade Jeffrey <wjeffrey@uwf.edu>
Subject: **Re: North Gulf Shelf Sampling**

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No, I do not understand.

The e-mail addressees are members of the FLCOOS and Oil Spill Academic Task Force for their information only, no implied consent or agreement with my position.

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Thanks very much for the offer of support, and please let me know if any of this is not clear or if you have additional concerns.

Regards,
Ernst

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____

Ernst Peebles, Ph.D.
Associate Professor
College of Marine Science
University of South Florida
140 Seventh Avenue South
St. Petersburg, Florida 33701-5016

office phone: [redacted]
lab phone: [redacted]
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____

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Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 13, 2010 10:26:05 AM EDT
To: Ernst Peebles <epeebles@marine.usf.edu>
Subject: Re: WBII May 12, 2010

I am in and out off stuff all day so just give me a call and I will do my best to grab it.

On May 12, 2010, at 9:10 PM, Ernst Peebles wrote:

Sounds good, Tom - I have some potential activities to run by you when you have time. I will be in a meeting all morning tomorrow (Thurs), but will need to discuss potential media coverage and oil-sample disposition with you tomorrow afternoon. I will call to discuss - please let me know if some times are better than others tomorrow afternoon. Ernst

At 08:29 PM 5/12/2010, you wrote:
FYI... Looks like things are going well, though I think we will drop the B4 station and maybe more if needed. Right now I am still hopeful they can make the spill zone Friday which is when we are on the ops plan and they are clearing some areas for us.

Begin forwarded message:

> From: RV Weatherbird <dwhnrda.cruise1@gmail.com>
> Date: May 12, 2010 4:25:11 PM EDT
> To: Tom Moore <Tom.Moore@noaa.gov>
> Cc: DFrenchMcCay@asascience.com
> Subject: WBII May 12, 2010
>
> Hi Tom and Deb,
> Please find attached our new locations for the bravo stations (excel
> spreadsheet, jpeg, and shape file). We are steaming towards B1 right
> now. We should be on station in approximately 3-5 hours. We have
> finished all of the SEAMAP stations, we were slightly delayed last
> night due to head troubles, but all fixed now. We are figuring around
> 2 to 2.5 hours of work per bravo station. We tightened up the station
> locations to be between 13-15NM apart. With transit, we are looking at
> 4 hours per station (10 stations) starting between 3:30 to 5:30 this
> evening (working around clock). We are going to hit them in order,
> ending in B10 and then we start steaming over to the D stations.
>
> We will check this e-mail again after our first station, while in

> transit to next (B2).
>
> Thanks
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>> Melanie should be able to help interpret this information... Were using
>> this info to target final spill area sampling. 1 jpg, and 2 ZIP files
>> attached.
>>
>>>
>>> Laurie, Rob, Troy,
>>> See also attached Ocean Imaging interpretations of remote sensing with oil
>>> thickness. Fresh thick oil should be surfacing oil.
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>>> Attached are my model results for 5AM today using the measured currents at
>>> the wellhead (ADCP). The Payne cruise should be sampling where oil is
>>> coming up and in the surface waters, but note the narrow plume. The 100
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>>> they were at P1 position at 8am running the ROV. The plan is they go from
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>>> indications I can find show that the rising plume extends to the east.
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>>> 0.7 kts), and the currents 100-300m down are ~0.2 kts to NE. Net seems to
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From: Ernst Peebles <epeebles@marine.usf.edu>
Date: May 13, 2010 2:19:08 PM EDT
To: Richard Snyder <rsnyder@uwf.edu>, Ernst Peebles <epeebles@marine.usf.edu>
Cc: "Hogarth, Bill" <billhogarth@usf.edu>, Ted.Switzer@myfwc.com, Tom.Moore@noaa.gov, Daniel Hahn <Daniel.Hahn@noaa.gov>, Bob.McMichael@fwc.state.fl.us, Arthur Jonathan <Jonathan.Arthur@dep.state.fl.us>, berry@fau.edu, drumbold@fgcu.edu, Ellington William Ross <WEllington@admin.fsu.edu>, "George A. Maul" <gmaul@fit.edu>, Felicia Coleman <coleman@bio.fsu.edu>, heithaus@fiu.edu, Jennifer.cherrier@famu.edu, morris@ncf.edu, portner@rsmas.miami.edu, pwelsh@unf.edu, gwhite@ju.edu, radha.pyati@unf.edu, rcowen@rsmas.miami.edu, "Richard E. Dodge" <dodge@nova.edu>, rpodemski@uwf.edu, shagen@mail.ucf.edu, sjaishan@ufl.edu, Aswani Volety <avolety@fgcu.edu>, Bill Hogarth <bill.hogarth@admin.usf.edu>, Donald Winter <dwinter@harris.com>, Eric Chassignet <echassignet@coaps.fsu.edu>, Graham Worthy <gworthy@mail.ucf.edu>, Ian Macdonald <imacdonald@fsu.edu>, Joseph Boyer <boyerj@fiu.edu>, Kumar Mahadevan <kumar@mote.org>, Manhar Dhanak <dhanak@fau.edu>, Michael Wade Kindel <mkindel1@fau.edu>, Mitchell Roffer <roffers@bellsouth.net>, Nick Shay <nshay@rsmas.miami.edu>, Peter Braza <pbraza@unf.edu>, Peter Sheng <pete@coastal.ufl.edu>, Peter Tatro <ptatro@hboi.edu>, Sandra Vargo <svargo@marine.usf.edu>, Steve Woll <swoll@weatherflow.com>, William Dewar <dewar@ocean.fsu.edu>, Wade Jeffrey <wjeffrey@uwf.edu>
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From: Tom Moore <Tom.Moore@noaa.gov>

Date: May 13, 2010 2:04:05 PM EDT
To: Stephanie Willis <Stephanie.Willis@noaa.gov>, "hahn >> Daniel Hahn" <Daniel.Hahn@noaa.gov>
Subject: Fwd: North Gulf Shelf Sampling

Begin forwarded message:

> **From:** Richard Snyder <rsnyder@uwf.edu>
> **Date:** May 13, 2010 1:55:07 PM EDT
> **To:** Ernst Peebles <epeebles@marine.usf.edu>
> **Cc:** "Hogarth, Bill" <billhogarth@usf.edu>, Ted.Switzer@myfwc.com, Tom.Moore@noaa.gov, Daniel Hahn <Daniel.Hahn@noaa.gov>, Bob.McMichael@fwc.state.fl.us, Arthur Jonathan <Jonathan.Arthur@dep.state.fl.us>, berry@fau.edu, drumbold@fgcu.edu, Ellington William Ross <WEllington@admin.fsu.edu>, "George A. Maul" <gmaul@fit.edu>, Felicia Coleman <coleman@bio.fsu.edu>, heithaus@fiu.edu, Jennifer.cherrier@famu.edu, morris@ncf.edu, portner@rsmas.miami.edu, pwelsh@unf.edu, gwhite@ju.edu, radha.pyati@unf.edu, rcowen@rsmas.miami.edu, "Richard E. Dodge" <dodge@nova.edu>, rpodemski@uwf.edu, shagen@mail.ucf.edu, sjaishan@ufl.edu, Aswani Volety <avolety@fgcu.edu>, Bill Hogarth <bill.hogarth@admin.usf.edu>, Donald Winter <dwinter@harris.com>, Eric Chassignet <echassignet@coaps.fsu.edu>, Graham Worthy <gworthy@mail.ucf.edu>, Ian Macdonald <imacdonald@fsu.edu>, Joseph Boyer <boyerj@fiu.edu>, Kumar Mahadevan <kumar@mote.org>, Manhar Dhanak <dhanak@fau.edu>, Michael Wade Kindel <mkindel1@fau.edu>, Mitchell Roffer <roffers@bellsouth.net>, Nick Shay <nshay@rsmas.miami.edu>, Peter Braza <pbraza@unf.edu>, Peter Sheng <pete@coastal.ufl.edu>, Peter Tatro <ptatro@hboi.edu>, Sandra Vargo <svargo@marine.usf.edu>, Steve Woll <swoll@weatherflow.com>, William Dewar <dewar@ocean.fsu.edu>, Wade Jeffrey <wjeffrey@uwf.edu>
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Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

[redacted] Office
Cell

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Date: May 13, 2010 3:52:13 PM EDT
To: Richard Snyder <rsnyder@uwf.edu>, Ernst Peebles <epeebles@marine.usf.edu>
Cc: "Hogarth, Bill" <billhogarth@usf.edu>, Ted.Switzer@myfwc.com, Tom.Moore@noaa.gov, Daniel Hahn <Daniel.Hahn@noaa.gov>, Bob.McMichael@fwc.state.fl.us, Arthur Jonathan <Jonathan.Arthur@dep.state.fl.us>, berry@fau.edu, drumbold@fgcu.edu, Ellington William Ross <WEllington@admin.fsu.edu>, "George A. Maul" <gmaul@fit.edu>, Felicia Coleman <coleman@bio.fsu.edu>, heithaus@fiu.edu, Jennifer.cherrier@famu.edu, morris@ncf.edu, portner@rsmas.miami.edu, pwelsh@unf.edu, qwhite@ju.edu, radha.pyati@unf.edu, rcowen@rsmas.miami.edu, "Richard E. Dodge" <dodge@nova.edu>, rpodemski@uwf.edu, shagen@mail.ucf.edu, sjaishan@ufl.edu, Aswani Volety <avolety@fgcu.edu>, Bill Hogarth <bill.hogarth@admin.usf.edu>, Donald Winter <dwinter@harris.com>, Eric Chassignet <echassignet@coaps.fsu.edu>, Graham Worthy <gworthy@mail.ucf.edu>, Ian Macdonald <imacdonald@fsu.edu>, Joseph Boyer <boyerj@fiu.edu>, Kumar Mahadevan <kumar@mote.org>, Manhar Dhanak <dhanak@fau.edu>, Michael Wade Kindel <mkindel1@fau.edu>, Mitchell Roffer <roffers@bellsouth.net>, Nick Shay <nshay@rsmas.miami.edu>, Peter Braza <pbraza@unf.edu>, Peter Sheng <pete@coastal.ufl.edu>, Peter Tatro <ptatro@hboi.edu>, Sandra Vargo <svargo@marine.usf.edu>, Steve Woll

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All,

As a point of clarification, our sampled stations run from just east of Pensacola Beach eastward to Apalachicola, extending from nearshore to ~35-50 nm offshore (much of NMFS stat zone 10 is actually offshore of Alabama). I do not want anyone to get the impression that we were not able to sample in the vicinity of Pensacola.

The Weatherbird II has managed to remain clear of oil and is now working around the clock in clean waters that feed the spill area from the south (plankton, neuston, SIPPER) - the crew will be working within the spill by Saturday. Things are going very well - thanks for all of the expressions of support.

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From: Debbie French McCay <DFrenchMcCay@asascience.com>
Date: May 13, 2010 3:37:11 PM EDT
To: Rob Ricker <Rob.Ricker@noaa.gov>, "Laurie.Sullivan@noaa.gov" <Laurie.Sullivan@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>
Cc: Stephanie Willis <Stephanie.Willis@noaa.gov>, Jill Rowe <jrowe@asascience.com>, Tom Moore <Tom.Moore@noaa.gov>
Subject: **FW: Deepwater Horizon - Dispersants and water column damages**

All,
I just talked with Tom about this idea. He noted that there are no acoustics allowed within 20 nmiles of the Wellhead, so this would need to be for studies outside that area.

Laurie: It would not fit in with next week's cruise.

Deb

Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted]

From: Rob Ricker [Rob.Ricker@noaa.gov]
Sent: Thursday, May 13, 2010 11:55 AM
To: David Demer
Cc: Jan.Roletto@noaa.gov; Debbie French McCay; Patrick Rutten; jrpayne@sbcglobal.net; Maria Brown; Lisa Symons; Robert A Taylor; Laurie Sullivan; Eileen Graham; Jill Rowe; Melanie Schroeder; Jaime Jahncke; Thompson, Charles H. ; Christopher T Gledhill
Subject: Re: Deepwater Horizon - Dispersants and water column damages

Thanks David for this information and the introductions to Charles Thompson and Chris Gledhill. Please include Dr. Dan Hahn on any future correspondence on this matter. He is our lead for the fisheries portion of the NRDA activities. I suspect that Dan has already connected with Charles and Chris, but best to fold him into this loop with all the activity and distractions at play.

Rob

David Demer wrote:

> Hello,
>
> The use of multi-frequency scientific echosounders, such as the Simrad EK60 (and the ME70 on the new NOAA FSVs), coupled with net or optical sampling, is a mature method for surveying the distributions and estimating abundances of fish and zooplankton. I have personally used acoustic-trawl or acoustic-optical sampling for surveying krill and fish (demersal, mid-water, and epi-pelagic), during the last ca. 20 years, but acoustic-trawl surveys have been used around the world for at least 40 years. That is, mature technologies and methods are available for post-spill monitoring. The bigger question is -- what pre-spill data is available to estimate baseline biomasses in the area, by species? I suggest contacting Charles Thompson and Chris Gledhill at the NMFS Southeast Fisheries Science Center (I've cc'd them so they know who to blame for this introduction). They are both very knowledgeable about acoustic-trawl surveys, and I expect they know, or know who knows, about historical survey data in the area.
>
> Sincerely,
>
> David Demer
>
> Jan Roletto wrote:
>
>> Hi Debby:
>>
>> Attached is an overview of biomass estimates using an EK 60. This was sent to you from one of our research partners Jaime Jahncke from PRBO Conservation Science. Jaime has suggested that Dave Demer from NMFS take a look at the situation and determine if the process of using this biomass assessment, along with ground truthing nets will provide needed data on rapid assessment of water column biomass, possible resources at risk, and fate of dispersants in the ecosystem. I've include Jaime's and Dave's email if you want to contact them directly.
>>
>> Sorry for the delay, I was working on a shoreline early notification for volunteers, for the spill.
>>
>> Let me know if you have any other questions. Both Pat and are still very interested in whether or not we can use this type of data and information for NRDA for this spill and in the future.
>>
>> Best, Jan
>>
>> On 5/7/10 1:21 PM, Debbie French McCay wrote:
>>
>>> Jan,
>>> Please do send your protocols. We are gathering information on what data exists for fish biomass, and what can be done to sample fish distributions. The focus is on developing data to quantify baseline

biomass pre-spill (or in reference areas). We are looking at
modeling the exposure and injury resulting, and to do this we need
to estimate pre-spill biomass.

Thanks,
Debbie

Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted]

____
From: Jan Roletto [Jan.Roletto@noaa.gov]
Sent: Friday, May 07, 2010 3:16 PM
To: Debbie French McCay
Cc: Patrick Rutten; jrpayne@sbcglobal.net; Maria Brown; Lisa Symons;
Rob Ricker; Robert A Taylor; Laurie Sullivan; Eileen Graham;
Jennifer Cragan
Subject: Re: Deepwater Horizon - Dispersants and water column damages

Hi Debbie:

The assessment of biomass using an EK 60 to record biomass is useful
but
is still relatively new. I can send you protocols from our project if
you'd like. We've never used this techniques for rapid response, fate
of oil/dispersants or resources at risk. It looks like you are well
poised to test this, if you are interested.

We have started to use an EK 60, using three frequencies to record
water
column biomass. In post-processing the biomass can be calculated, but
you would also need to ground truth the images by collecting a few
trawls. Pat and I are hoping that this type of technique can also be
used for rapid assessment, having an individual annotate images on the
screen in real time, with "estimates" of denser schools/patches of
fish,
krill, shrimp, etc.

Best, Jan

On 5/6/10 11:34 AM, Debbie French McCay wrote:

> Jan,
> I am working with Dan Hahn and Tom Moore re a ichthyoplankton
> sampling cruise with USF scientists that is now sampling on FL
> shelf but next week will go to the release site area. That plan is
> still being developed (for the second leg at the release site).
> Sampling will be in the upper 350m, focused on surface mixed layer
> to about 40m.
>
> Is there a fish finder that can record biomass while underway? I
> am not familiar with the latest technology re this. Can you give
> me some info on that? We had no data on pelagic fish biomass out in
> the release site area.
>
> Thanks
> Debbie

Deborah French McCay, PhD
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879
(office) [redacted]
(fax) [redacted]
dfrenchmccay@asascience.com or
d.french.mccay@asascience.com

-----Original Message-----
From: Jan Roletto [mailto:Jan.Roletto@noaa.gov]
Sent: Thursday, May 06, 2010 2:03 PM
To: Debbie French McCay
Cc: Patrick Rutten; jrpayne@sbcglobal.net; Maria Brown; Lisa Symons; Rob Ricker; Robert A Taylor; Laurie Sullivan; Eileen Graham; Jennifer Cragan
Subject: Re: Deepwater Horizon - Dispersants and water column damages

Hi Debbie:

Sounds great. Good to hear you're on it!

Is it possible that the vessel has a recordable fish finder, if not an ER or EK 60, for recoding underway water column biomass? If not, is it
possible to have a second vessel follow the same track line, within 12 hours of the initial vessel, with some type of recordable fish finder or
EK 60?

Best, Jan

On 5/6/10 10:43 AM, Debbie French McCay wrote:

> Jan and Pat,
>
> The Water Column TWG has a cruise leaving the dock at 1800 CDT today to go out and get water samples in the vicinity and in the rising oil plume. We are doing CTDs, THC, PAHs BTEX, fluorescence in upper 50m, oil droplet sizes. Measuring currents upper 50m. Also have ROV to sample bottom water.
>
> We can coordinate via the TWG head Laurie Sullivan, cc'd here. There is a completed cruise plan. Jim Payne is on the cruise, assisted by an ASA person (Eileen Graham). Another ASA person Jennifer Cragan is in the command center with Laurie.
>
> Debbie
>
> Deborah French McCay, PhD
> Applied Science Associates, Inc. (ASA)
> 55 Village Square Drive
> South Kingstown, RI 02879
> (office) [redacted]
> (fax) [redacted]
> dfrenchmccay@asascience.com or
> d.french.mccay@asascience.com

-----Original Message-----
From: Jan Roletto [mailto:Jan.Roletto@noaa.gov]
Sent: Thursday, May 06, 2010 1:11 PM
To: Patrick Rutten; Debbie French McCay; jrpayne@sbcglobal.net
Cc: Maria Brown; Lisa Symons; Rob Ricker
Subject: Deepwater Horizon - Dispersants and water column damages

Hi Pat:

On another NRDA issue, since they are now using dispersants to break up the spill, is there anyone on scene that is conducting baseline water column resources assessment? Jim Payne and I spoke a while ago at an OSPR SSEP meeting, about testing monitoring techniques to assess water column resources, biomass estimates, depth of thermoclines, all to help determine fate of dispersed oil in the food chain (e.g. possibly fish, bird and baleen whale injuries).

Jim and Debby French-McCay had received some funds a few years ago from OSPR to start to test some of the water column assessment techniques for fate of dispersants. We had spoke about using this technique for NRDA, using CTD data and EK 60 data to estimate water column biomass and aerial surveys for resources at risk. Any interest in pursuing this effort for Deepwater Horizon?

If there is interest in pursuing this new level of NRDA efforts I'd be happy to work with Jim and Debby on this effort. Perhaps, hopefully, one of them are already on scene?

Best, Jan

On 5/5/10 8:16 PM, Patrick Rutten wrote:

> ALL:
> I expect you have already provided this information,.... but I was contacted by Rob Ricker, NOS, ARD who is leading the damage assessment for NOS on the Deepwater Horizon spill, to help identify who would have expertise on turtle and marine mammal necropsy, if needed.
>
> Ideally, the biologist or DVM would be experienced in what specific tests to run, or what physical observations to make in a necropsy that would indicate oil exposure, or signs of ingestion or aspiration. According to Rob the best situation would be to have the biologist onsite in the Gulf to establish a natural resource damage assessment protocol...field to lab. Specific facility for processing animals hasn't been identified, could be Louisiana, could be Florida. As an FYI the 30+ sea turtles that recently washed up were likely the result of fishermen not installing TED's on their nets (a nice black

eye!).

All expenses are covered. Just need to know who's is available and qualified.

*Usha - You'd know who at La Jolla and NMML would fit the quals for mammals and turtles
Sam / Mike - I know PIFSC has some real turtle pro's
Barb - I'm sure you know who in the SE would be capable and could also
suggest facilities
Maria/Jan - I'm including you since the DVM at the Marine Mammal Center may (may not) be a likely candidate to ask, but I don't have his name.
*
As with everything associated with this spill, I need a quick response
please. A negative response would be appreciated.
Thanks,
Patrick

--
Rob Ricker, Ph.D.
Regional Manager, SW Region
Assessment & Restoration Division
Office of Response and Restoration, NOAA
777 Sonoma Ave, Suite 219A
Santa Rosa, CA 95404
C [redacted]
F [redacted]
E rob.ricker@noaa.gov

Begin forwarded message:

From: Daniel Hahn <Daniel.Hahn@noaa.gov>
Date: May 13, 2010 4:42:15 PM EDT
To: "frank.csulak" <Frank.Csulak@noaa.gov>
Cc: Debbie Payton <Debbie.Payton@noaa.gov>, Lisa Dipinto <Lisa.Dipinto@noaa.gov>, Ian J Zelo <ian.j.zelo@noaa.gov>, Doug Helton <Doug.Helton@noaa.gov>, Glen Watabayashi <Glen.Watabayashi@noaa.gov>, Bill Lehr <Bill.Lehr@noaa.gov>, Debbie French McCay <DFrenchMcCay@asascience.com>, Tom Moore <Tom.Moore@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: **Re: Need Help - Surfacing oil locaiton**

Debbie Payton and others,
My understanding is that, for the time being, we have a pretty good handle on where oil is coming to the surface (i.e. about 2 km to the E). The reason we were requesting air support is that this location shifts due to subsurface currents and that, at times, we didn't have good information about where the oil was surfacing. I understand the complications with seeing surfacing oil when there is lots of oil on the water.

The objective of the SIPPER cruise is to collect information on plankton assemblages in the vicinity of the rising plume, and potentially to examine droplet size in the rising plume. Thus, knowing where the plume is coming to the surface allows us to plan our transect locations in such a way that we have better probability of hitting the plume.
Any updates from the overflights tomorrow will help us confirm that our proposed plume transects, which are planned for Saturday, are in the right location and that the rising plume hasn't shifted. A photo with drilling rig as a reference is very helpful (like attached).

Thanks for your assistance in helping us pin down this information.
Dan

frank.csulak wrote:

> Dan, I am trying to address your request for overflight information. See email from Debbie Payton. Please address her questions. Frank
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> Debbie Payton wrote:
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>> The overflights are being coordinated in the field (I'm assuming at each CP?) In Seattle, we are giving direction to the NOAA observers and the Ocean Imaging and NASA imaging flights.
>> Identifying where the oil is surfacing is not a simple matter anymore, it was a bit easier at the beginning of the spill when there wasn't as much oil in the area. I expect only the helos may be able to determine where the oil is surfacing, and it might require quite a bit of searching to see if they can see bubbles or blossoming and coordinating with the modeling effort to know where to look. Initial estimates (without adding subsea dispersants) were that oil would surface in 3-4 hours within 1.5 miles of the source. Initial observations confirmed this and we haven't tried to confirm it since that I am aware of.
>>
>> What is the question we are trying to answer and how much effort is it worth? Is knowing within a given radius good enough? If this is an important question for someone, I expect we would need a dedicated platform each day to get this information. If we only need an approximate, then we can use the modeling to answer it.
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>> frank.csulak wrote:
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--
Daniel Hahn, Ph.D.
Regional Resource Coordinator
National Oceanic and Atmospheric Administration
Assessment & Restoration Division, SE Region
263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: [redacted]
Fax: [redacted]
Cell: [redacted]

[redacted]

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Begin forwarded message:

> **From:** Debbie French McCay <DFrenchMcCay@asascience.com>
> **Date:** May 13, 2010 5:07:49 PM EDT
> **To:** Daniel Hahn <Daniel.Hahn@noaa.gov>, "frank.csulak" <Frank.Csulak@noaa.gov>
> **Cc:** Debbie Payton <Debbie.Payton@noaa.gov>, Lisa Dipinto <Lisa.Dipinto@noaa.gov>, Ian J Zelo <ian.j.zelo@noaa.gov>, Doug Helton <Doug.Helton@noaa.gov>, Glen Watabayashi <Glen.Watabayashi@noaa.gov>, Bill Lehr <Bill.Lehr@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
> **Subject: RE: Need Help - Surfacing oil locaiton**
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> All,
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> Deborah French McCay
> Applied Science Associates, Inc. (ASA)
> 55 Village Square Drive
> South Kingstown, RI 02879 USA
> d.french.mccay@asascience.com
> voc: *B6 Privacy*
> ________________________________
> From: Daniel Hahn [Daniel.Hahn@noaa.gov]
> Sent: Thursday, May 13, 2010 4:42 PM
> To: frank.csulak
> Cc: Debbie Payton; Lisa Dipinto; Ian J Zelo; Doug Helton; Glen Watabayashi; Bill Lehr; Debbie French McCay; Tom Moore; Stephanie Willis
> Subject: Re: Need Help - Surfacing oil locaiton
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Daniel Hahn, Ph.D.
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263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: [redacted]

B6 Privacy
Fax: B6 Privacy
Cell: B6 Privacy
Begin forwarded message:

From: Debbie Payton <Debbie.Payton@noaa.gov>
Date: May 13, 2010 6:23:45 PM EDT
To: Debbie French McCay <DFrenchMcCay@asascience.com>
Cc: Daniel Hahn <Daniel.Hahn@noaa.gov>, "frank.csulak" <Frank.Csulak@noaa.gov>, Lisa Dipinto <Lisa.Dipinto@noaa.gov>, Ian J Zelo <ian.j.zelo@noaa.gov>, Doug Helton <Doug.Helton@noaa.gov>, Glen Watabayashi <Glen.Watabayashi@noaa.gov>, Bill Lehr <Bill.Lehr@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: **Re: Need Help - Surfacing oil locaiton**

Debbie,
you scooped my response (i was halfway through typing and keep getting pulled away). But, of course, you are correct. The oil is generally surfacing within 1-2 km from the source and within 3-4 hours (without injection), confirmed both by obs and modeling. today's obs have the oil surfacing to the ene, which makes sense given the rig and rov adcps. following is the website with the adcp measurements - some days there is quite a shear in the vertical. the NGOM model (which you now should have access to through CJ?) has been doing a pretty good job with subsurface currents as well.

we will make sure that in prep for Saturday an observer identifies the surfacing area tomorrow, then I would look at the ADCPs and modify the sampling plan based on those obs (if we know approx what time the vessel will be in the area, we can try and schedule the source overflight to coincide with that time to give better direction).

http://metocean.fugrogeos.com/bp

Debbie

Debbie French McCay wrote:

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voc: [redacted]

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Regional Resource Coordinator
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Assessment & Restoration Division, SE Region
263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: (727) 551-5715
Fax: [redacted]
Cell: [redacted]

Begin forwarded message:

From: Brenda Jones <bkjones@usgs.gov>
Date: May 13, 2010 6:56:41 PM EDT
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Subject: DEEPOIL oilspill remote sensing telecon, Friday, May 14 at 1300 CDT

We will be having a remote sensing working group telecon tomorrow at 1400 EDT, 1300CDT, 1200MDT, and 1100PDT. The notes from yesterdays call are attached. Please provide any updates/comments to me.

Dial in - [redacted]#

Participant Feature Keys	
* 3	Exit - exit the call
* 4	Instructions - conference instructions
* 6	Mute/Unmute - caller controlled muting

Following is a brief agenda - I have not confirmed participation.
1. Introductions
2. NOAA update
3. USCG update
4. EagleVision
5. NGA
6. NASA/ASTER
7. IRSCC
8. EPA
9. USDA
10. States
11. Roundtable

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RSWG_0512....doc (37.5 KB)

RSWG_0513....doc (37.0 KB)
Begin forwarded message:

> **From:** Tom Moore <tom.moore@noaa.gov>
> **Date:** May 13, 2010 7:20:46 PM EDT
> **To:** "dwhnrda.cruise1@gmail.com" <dwhnrda.cruise1@gmail.com>
> **Subject: Fwd: Need Help - Surfacing oil locaiton**
>
> Sent from my iPad
>
> Begin forwarded message:
>
>> **From:** Debbie Payton <Debbie.Payton@noaa.gov>
>> **Date:** May 13, 2010 6:23:45 PM EDT
>> **To:** Debbie French McCay <DFrenchMcCay@asascience.com>
>> **Cc:** Daniel Hahn <Daniel.Hahn@noaa.gov>, "frank.csulak" <Frank.Csulak@noaa.gov>, Lisa Dipinto <Lisa.Dipinto@noaa.gov>, Ian J Zelo <ian.j.zelo@noaa.gov>, Doug Helton <Doug.Helton@noaa.gov>, Glen Watabayashi <Glen.Watabayashi@noaa.gov>, Bill Lehr <Bill.Lehr@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
>> **Subject: Re: Need Help - Surfacing oil locaiton**
>>
>> Debbie,
>> you scooped my response (i was halfway through typing and keep getting pulled away). But, of course, you are correct. The oil is generally surfacing within 1-2 km from the source and within 3-4 hours (without injection), confirmed both by obs and modeling. today's obs have the oil surfacing to the ene, which makes sense given the rig and rov adcps. following is the website with the adcp measurements - some days there is quite a shear in the vertical. the NGOM model (which you now should have access to through CJ?) has been doing a pretty good job with subsurface currents as well.
>>
>> we will make sure that in prep for Saturday an observer identifies the surfacing area tomorrow, then I would look at the ADCPs and modify the sampling plan based on those obs (if we know approx what time the vessel will be in the area, we can try and schedule the source overflight to coincide with that time to give better direction).
>>
>> http://metocean.fugrogeos.com/bp
>>
>> Debbie
>>
>> Debbie French McCay wrote:
>>
>>> All,
>>>
>>> From my analysis and modeling, the rising oil should be surfacing close to the release site and down-current. The ADCP at the wellhead generally shows weak currents (<0.2 kt) from 3900ft (deepest point sampled) to about 400 ft below the surface. The ADCP measurements at 315 and 210 ft below the water surface have shown eastward currents up to 0.7 kts the last few days, but are slowing now to < 0.2kts. These are the shallowest measurements available, but I am assuming they apply all the way to the surface (for lack of any other data). Early in the spill, surface (200-300ft) currents were also weak. May 5-7 they were to the south, May 7-10 to the SE, and recently to the E. All of this is based on transport by the currents as measured by ADCP 42916 deployed May 1 at the wellhead site.
>>>
>>> We would like some confirmation of this model, so we can locate sampling in the rising plume. We need to get these samples to confirm droplet sizes and dissolved PAHs in that water, and the algorythms used to model such for the purposes of water column injury modeling.
>>>
>>> The Ocean Imaging overflight interpretations have been very valuable for this analysis, and the ones we have compared seem to agree with this model of what is going on. Today we have the "Payne cruise" sampling 2km E of the Wellhead, and they are seeing some oil there. Tomorrow and

Sat the Sipper cruise is sampling the area, and we are trying to place them downstream of (Fri) and in the plume (Sat). Next week we are working on a plan for more water sampling. Perhaps coordination of the Ocean Imaging overflights with these plans would do the trick. If we can confirm the model, we can follow the ADCP measurements to locate our sampling.

Thanks for your help.
Debbie

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voc: [redacted]

From: Daniel Hahn [Daniel.Hahn@noaa.gov]
Sent: Thursday, May 13, 2010 4:42 PM
To: frank.csulak
Cc: Debbie Payton; Lisa Dipinto; Ian J Zelo; Doug Helton; Glen Watabayashi; Bill Lehr; Debbie French McCay; Tom Moore; Stephanie Willis
Subject: Re: Need Help - Surfacing oil locaiton

Debbie Payton and others,
My understanding is that, for the time being, we have a pretty good handle on where oil is coming to the surface (i.e. about 2 km to the E). The reason we were requesting air support is that this location shifts due to subsurface currents and that, at times, we didn't have good information about where the oil was surfacing. I understand the complications with seeing surfacing oil when there is lots of oil on the water.

The objective of the SIPPER cruise is to collect information on plankton assemblages in the vicinity of the rising plume, and potentially to examine droplet size in the rising plume. Thus, knowing where the plume is coming to the surface allows us to plan our transect locations in such a way that we have better probability of hitting the plume.

Any updates from the overflights tomorrow will help us confirm that our proposed plume transects, which are planned for Saturday, are in the right location and that the rising plume hasn't shifted. A photo with drilling rig as a reference is very helpful (like attached).

Thanks for your assistance in helping us pin down this information.
Dan

frank.csulak wrote:

> Dan, I am trying to address your request for overflight information. See email from Debbie Payton. Please address her questions. Frank
>
> Debbie Payton wrote:
>
>> The overflights are being coordinated in the field (I'm assuming at each CP?) In Seattle, we are giving direction to the NOAA observers and the Ocean Imaging and NASA imaging flights.
>> Identifying where the oil is surfacing is not a simple matter anymore, it was a bit easier at the beginning of the spill when there wasn't as much oil in the area. I expect only the helos may be able to determine where the oil is surfacing, and it might require quite a bit of searching to see if they can see bubbles or

blossoming and coordinating with the modeling effort to know where to look. Initial estimates (without adding subsea dispersants) were that oil would surface in 3-4 hours within 1.5 miles of the source. Initial observations confirmed this and we haven't tried to confirm it since that I am aware of.

What is the question we are trying to answer and how much effort is it worth? Is knowing within a given radius good enough? If this is an important question for someone, I expect we would need a dedicated platform each day to get this information. If we only need an approximate, then we can use the modeling to answer it.

frank.csulak wrote:

> Who is the POC for coordinating NOAA overflights? Received request from Dan Hahn, NOAA/ORR St. Pete for our response overflights on a daily basis to fly over the location where the oil is coming to the surface, document lat/long, take photo with a reference point contained in the photo. This request came in a couple of days ago.
> Frank

--
Daniel Hahn, Ph.D.
Regional Resource Coordinator
National Oceanic and Atmospheric Administration
Assessment & Restoration Division, SE Region
263 13th Avenue South
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Begin forwarded message:

From: Daniel Hahn <Daniel.Hahn@noaa.gov>
Date: May 13, 2010 9:33:05 PM EDT
To: Debbie Payton <Debbie.Payton@noaa.gov>
Cc: Debbie French McCay <DFrenchMcCay@asascience.com>, "frank.csulak" <Frank.Csulak@noaa.gov>, Lisa Dipinto <Lisa.Dipinto@noaa.gov>, Ian J Zelo <ian.j.zelo@noaa.gov>, Doug Helton <Doug.Helton@noaa.gov>, Glen Watabayashi <Glen.Watabayashi@noaa.gov>, Bill Lehr <Bill.Lehr@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: Re: Need Help - Surfacing oil locaiton

Regarding the timing, the Weatherbird II should be doing transects in the vicinity of the plume throughout the morning Saturday, May 15. They are overnighting outside the spill area and will be heading in somewhere around daybreak. If information can be conveyed quickly back from a morning overflight, that could be very useful, that is, if adjustments can be made the day of the spill in coordination with SIMOPS. Otherwise, Friday's overflights are going to provide the best information.

Thanks again for the help everyone.
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http://metocean.fugrogeos.com/bp

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Thanks for your help.
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Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted]

From: Daniel Hahn [Daniel.Hahn@noaa.gov]
Sent: Thursday, May 13, 2010 4:42 PM
To: frank.csulak
Cc: Debbie Payton; Lisa Dipinto; Ian J Zelo; Doug Helton; Glen Watabayashi; Bill Lehr; Debbie French McCay; Tom Moore; Stephanie Willis
Subject: Re: Need Help - Surfacing oil locaiton

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Daniel Hahn, Ph.D.
Regional Resource Coordinator
National Oceanic and Atmospheric Administration
Assessment & Restoration Division, SE Region
263 13th Avenue South
St. Petersburg, FL 33701

email: Daniel.Hahn@noaa.gov
Phone: (727) 551-5715
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To: Daniel Hahn <Daniel.Hahn@noaa.gov>, Debbie Payton <Debbie.Payton@noaa.gov>
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Subject: RE: Need Help - Surfacing oil locaiton

Debbie,
Thanks for the support and the ftp on the adcps -- was not aware of these. Yes, CJ gave us the link to NGOM, and we'll take a look and work with that.
Debbie

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>> voc: [redacted]
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Begin forwarded message:

From: George Maul <gmaul@fit.edu>
Date: May 13, 2010 9:51:34 PM EDT
To: Ernst Peebles <epeebles@marine.usf.edu>, Richard Snyder <rsnyder@uwf.edu>
Cc: "Hogarth, Bill" <billhogarth@usf.edu>, "Ted.Switzer@myfwc.com" <Ted.Switzer@myfwc.com>, "Tom.Moore@noaa.gov" <Tom.Moore@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>, "Bob.McMichael@fwc.state.fl.us" <Bob.McMichael@fwc.state.fl.us>, Arthur Jonathan <Jonathan.Arthur@dep.state.fl.us>, "berry@fau.edu" <berry@fau.edu>, "drumbold@fgcu.edu" <drumbold@fgcu.edu>, Ellington William Ross <WEllington@admin.fsu.edu>, Felicia Coleman <coleman@bio.fsu.edu>, "heithaus@fiu.edu" <heithaus@fiu.edu>, "Jennifer.cherrier@famu.edu" <Jennifer.cherrier@famu.edu>, "morris@ncf.edu" <morris@ncf.edu>, "portner@rsmas.miami.edu" <portner@rsmas.miami.edu>, "pwelsh@unf.edu" <pwelsh@unf.edu>, "qwhite@ju.edu" <qwhite@ju.edu>, "radha.pyati@unf.edu" <radha.pyati@unf.edu>, "rcowen@rsmas.miami.edu" <rcowen@rsmas.miami.edu>, "Richard E. Dodge" <dodge@nova.edu>, "rpodemski@uwf.edu" <rpodemski@uwf.edu>, "shagen@mail.ucf.edu" <shagen@mail.ucf.edu>, "sjaishan@ufl.edu" <sjaishan@ufl.edu>, Aswani Volety <avolety@fgcu.edu>, Bill Hogarth <bill.hogarth@admin.usf.edu>, Donald Winter <dwinter@harris.com>, Eric Chassignet <echassignet@coaps.fsu.edu>, Graham Worthy <gworthy@mail.ucf.edu>, Ian Macdonald <imacdonald@fsu.edu>, Joseph Boyer <boyerj@fiu.edu>, Kumar Mahadevan <kumar@mote.org>, Manhar Dhanak <dhanak@fau.edu>, Michael Wade Kindel <mkindel1@fau.edu>, Mitchell Roffer <roffers@bellsouth.net>, Nick Shay <nshay@rsmas.miami.edu>, Peter Braza <pbraza@unf.edu>, Peter Sheng <pete@coastal.ufl.edu>, Peter Tatro <ptatro@hboi.edu>, Sandra Vargo <svargo@marine.usf.edu>, Steve Woll <swoll@weatherflow.com>, William Dewar <dewar@ocean.fsu.edu>, Wade Jeffrey <wjeffrey@uwf.edu>
Subject: **RE: North Gulf Shelf Sampling**

I think it would be important if any hydrocast data were confirmed independently. That is does the temperature profile from an XBT agree with that from a CTD? Anybody have reversing thermometers? TKX, George Maul

____
From: Ernst Peebles [epeebles@marine.usf.edu]
Sent: Thursday, May 13, 2010 3:52 PM
To: Richard Snyder; Ernst Peebles
Cc: Hogarth, Bill; Ted.Switzer@myfwc.com; Tom.Moore@noaa.gov; Daniel Hahn; Bob.McMichael@fwc.state.fl.us; Arthur Jonathan; berry@fau.edu; drumbold@fgcu.edu; Ellington William Ross; George Maul; Felicia Coleman; heithaus@fiu.edu; Jennifer.cherrier@famu.edu; morris@ncf.edu; portner@rsmas.miami.edu; pwelsh@unf.edu; qwhite@ju.edu; radha.pyati@unf.edu; rcowen@rsmas.miami.edu; Richard E. Dodge; rpodemski@uwf.edu; shagen@mail.ucf.edu; sjaishan@ufl.edu; Aswani Volety; Bill Hogarth; Donald Winter; Eric Chassignet; Graham Worthy; Ian Macdonald; Joseph Boyer; Kumar Mahadevan; Manhar Dhanak; Michael Wade Kindel; Mitchell Roffer; Nick Shay; Peter Braza; Peter Sheng; Peter Tatro; Sandra Vargo; Steve Woll; William Dewar; Wade Jeffrey
Subject: Re: North Gulf Shelf Sampling

All,

As a point of clarification, our sampled stations run from just east of Pensacola Beach eastward to Apalachicola, extending from nearshore to ~35-50 nm offshore (much of NMFS stat zone 10 is actually offshore of Alabama). I do not want anyone to get the

impression that we were not able to sample in the vicinity of Pensacola.

The Weatherbird II has managed to remain clear of oil and is now working around the clock in clean waters that feed the spill area from the south (plankton, neuston, SIPPER) - the crew will be working within the spill by Saturday. Things are going very well - thanks for all of the expressions of support.

Ernst

At 12:55 PM 5/13/2010, Richard Snyder wrote:
Ernst:

Region 10, the area most likely to be impacted, remains unsampled with SEAMAP protocols that will be compatible to the exiting and future dataset. I will not belabor the point further.

On Thu, May 13, 2010 at 1:19 PM, Ernst Peebles <epeebles@marine.usf.edu<mailto:epeebles@marine.usf.edu> > wrote:

Richard,

We adhered to the SEAMAP probabilistic design and protocols to allow data comparability with other cruises (a cost-effective use of tax dollars).

After much debate, we decided as a group to work east-to-west because 1) this would be most efficient, given that we had limited time, and 2) more importantly, it would help ensure that we were working clean-to-dirty - if the vessel and gear became contaminated early, then ALL pre-impact sampling would have to stop.

We have always recognized that your region is in the most immediate danger, and it was written into our cruise plan that we would sample the unaffected parts of stat zone 10 if time allowed. We do understand that finishing 24 stations was not as good as our original plan (32 stations plus at least part of stat zone 10). The crew worked very, very hard during the limited time they had, but the pace was not fast enough to get everything done in time.

The second vessel happens to be in the Key West area as part of another cruise - the possible sampling of spill materials as they pass by would be opportunistic (also good use of taxpayers' dollars).

In short, all of the rational arguments you raise were carefully considered beforehand, and we are doing our best to be constructive.

Ernst

At 09:07 AM 5/13/2010, Richard Snyder wrote:
Ernst:

I do have some concerns, and your rationale to not sample region 10 because it has been "compromised" I do not understand. I waited till this morning to reply hoping the temptation to use language better suited to the pitching deck of a ship in rough weather would subside. I wish I could tell you that is the case.

Region 10 is in the most immediate danger in all of Florida, which at least you acknowledge. I do not understand the rationale to discard the rest of the region because the SW corner may have been impacted. I would think, but then I'm just a low rate scientist in the west of Florida, that fact alone would have created an urgency to get over here and sample region 10 first. The ship sampled East region 8 first, then to the West? What? While we have a window with SE winds keeping the plume away?

You state this is not an "official SEAMAP cruise" and you sampled only 24 of the stations, so adherence to a probablistic sampling scheme (is that what happened?) requiring you discard the most at risk region of the Florida Shelf because of a probability of randomly picking the two stations in the SW corner (?) in the face of a potential ecological catastrophe, seems like exactly the kind of <deleted> decision that causes general public to shake their heads in disgust at their tax dollar paid public servants and the decisions made for the application of tax payer resources, State and Federal.

Can you honestly tell me that if region 5, the middle grounds and Tampa/St. Pete, was in the same situation as we are facing in region 10, that the same decisions would have been made? I'm sure the people up here in the Panhandle will be comforted to know you are prepared to station a ship in the Florida straits for the remote chance significant concentrations of petroleum and/or dispersants will reach there (yes I understand the loop current) when we are facing a more real probability of oil impact here in

region 10, offshore and on shore.

No, I do not understand.

The e-mail addressees are members of the FLCOOS and Oil Spill Academic Task Force for their information only, no implied consent or agreement with my position.

On Wed, May 12, 2010 at 5:58 PM, Ernst Peebles <epeebles@marine.usf.edu<mailto:epeebles@marine.usf.edu> > wrote:

Richard,
Our (FWRI and USF) first priority was to establish pre-impact conditions within those Florida continental-shelf waters that appeared to be most likely to be affected by the spill. At the time of cruise-plan development, panhandle waters appeared to be the most vulnerable. The overall plan was to repeat this approach as necessary in other regions of the West Florida Shelf, positioning future cruises ahead of the spill as it moved east and south. At this point, we do not have funding for additional cruises of this type, and we are watching spill interactions with the Loop Current. Should the oil spill become entrained in the Loop Current, we may be able to position another vessel within the Florida Straits to intercept the oil for chemical fingerprinting.
Early NOAA spill maps indicated oil was present in the southwest corner of NMFS stat zone 10, and 2 of our 11 SEAMAP-style stations were within this area of stat zone 10 (note the term "SEAMAP-style" - our ongoing cruise is not an official SEAMAP cruise). We were therefore concerned that stat zone 10 had been compromised or that it could be argued that it had been compromised. We decided to prioritize stat zones 8 and 9, working west towards the spill. By using SEAMAP protocols to identify stations, we could assure that these stations would be revisited during at least one future SEAMAP cruise that had already been scheduled for July, 2010.
NOAA's first priority was to study the spill site outside Florida waters. In order to stay on schedule for the NOAA work, we had to reduce the number of SEAMAP-style stations from 32 to 24. After departing Pensacola and ending the SEAMAP-style work, the WBII headed toward the spill area. I am still awaiting today's update via satellite phone. It is my understanding that no SEAMAP-style work was done in stat zone 10, although I will check to see what, if anything, was done there during transit to the spill area.
The Pensacola port call was scheduled after the WBII had left St. Pete. It's purpose was 1) to deliver age-sensitive water and sediment samples to shore for shipment to the lab in Texas, and 2) to exchange crew and load new equipment and supplies. At the time of scheduling this port call, the WBII had a full complement of scientific and ship's crew. There is presently no plan to make another port call to Pensacola.

Thanks very much for the offer of support, and please let me know if any of this is not clear or if you have additional concerns.
Regards,
Ernst

At 01:54 PM 5/12/2010, you wrote:
I really don't like being a pain in the rear, but I am confused, please help.
The Weatherbird cruise plan has stations prioritized for Zones 8 & 9, but for Zone 10:
"Figure 6. Locations of SEAMAP sampling stations within NMFS statistical zone 10. At present we do not anticipate sampling within NMFS statistical zone 10 unless sampling within NMFS statistical zones 8 and 9 are completed ahead of schedule."
Can someone explain to me why Zone 10, off of Pensacola, Santa Rosa Island, and Perdido Key, likely the first place the oil will come, is not a priority over stations to the east? Did stations around the corner north and east of Cape San Blas get priority over zone 10?
1) how was the sampling for pre-oil condition prioritized? Why is zone 10 a secondary consideration?
2) did they have time to do any sampling in zone 10? Our local paper stated they collect "a" water sample 16 miles south of Pensacola...
3) was the stop in Pensacola yesterday (tuesday) scheduled?
4) will they stop back here before heading to FIO? Anything they need?
People here at the likely point of first Florida impact keep asking me what the state is doing to look after their interests.
I'm hoping that I'm missing something.
--
Richard A. Snyder, Ph.D.
Professor and Director
Center for Environmental Diagnostics and Bioremediation (CEDB)
http://uwf.edu/cedb/
University of West Florida TEL: (850) 474-2806
11000 University Parkway FAX: -3130
Pensacola, FL 32514 http://uwf.edu/rsnyder/

Ernst Peebles, Ph.D.
Associate Professor
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office phone: (727) 553-3983
lab phone: [redacted]
fax: [redacted]

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Date: May 13, 2010 11:17:13 PM EDT
To: George Maul <gmaul@fit.edu>, Richard Snyder <rsnyder@uwf.edu>
Cc: "Hogarth, Bill" <billhogarth@usf.edu>, "Ted.Switzer@myfwc.com" <Ted.Switzer@myfwc.com>, "Tom.Moore@noaa.gov" <Tom.Moore@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>, "Bob.McMichael@fwc.state.fl.us" <Bob.McMichael@fwc.state.fl.us>, Arthur Jonathan <Jonathan.Arthur@dep.state.fl.us>, "berry@fau.edu" <berry@fau.edu>, "drumbold@fgcu.edu" <drumbold@fgcu.edu>, Ellington William Ross <WEllington@admin.fsu.edu>, Felicia Coleman <coleman@bio.fsu.edu>, "heithaus@fiu.edu" <heithaus@fiu.edu>, "Jennifer.cherrier@famu.edu" <Jennifer.cherrier@famu.edu>, "morris@ncf.edu" <morris@ncf.edu>, "portner@rsmas.miami.edu" <portner@rsmas.miami.edu>, "pwelsh@unf.edu" <pwelsh@unf.edu>, "qwhite@ju.edu" <qwhite@ju.edu>, "radha.pyati@unf.edu" <radha.pyati@unf.edu>, "rcowen@rsmas.miami.edu" <rcowen@rsmas.miami.edu>, "Richard E. Dodge" <dodge@nova.edu>, "rpodemski@uwf.edu" <rpodemski@uwf.edu>, "shagen@mail.ucf.edu" <shagen@mail.ucf.edu>, "sjaishan@ufl.edu" <sjaishan@ufl.edu>, Aswani Volety <avolety@fgcu.edu>, Bill Hogarth <bill.hogarth@admin.usf.edu>, Donald Winter <dwinter@harris.com>, Eric Chassignet <echassignet@coaps.fsu.edu>, Graham Worthy <gworthy@mail.ucf.edu>, Ian Macdonald <imacdonald@fsu.edu>, Joseph Boyer <boyerj@fiu.edu>, Kumar Mahadevan <kumar@mote.org>, Manhar Dhanak <dhanak@fau.edu>, Michael Wade Kindel <mkindel1@fau.edu>, Mitchell Roffer <roffers@bellsouth.net>, Nick Shay <nshay@rsmas.miami.edu>, Peter Braza <pbraza@unf.edu>, Peter Sheng <pete@coastal.ufl.edu>, Peter Tatro <ptatro@hboi.edu>, Sandra Vargo <svargo@marine.usf.edu>, Steve Woll <swoll@weatherflow.com>, William Dewar <dewar@ocean.fsu.edu>, Wade Jeffrey <wjeffrey@uwf.edu>
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St. Petersburg, Florida 33701-5016
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B6 Privacy

No virus found in this incoming message.
Checked by AVG - www.avg.com
Version: 8.5.437 / Virus Database: 271.1.1/2871 - Release Date: 05/13/10 06:26:00

Begin forwarded message:

From: George Maul <gmaul@fit.edu>
Date: May 14, 2010 10:59:25 AM EDT
To: Ernst Peebles <epeebles@marine.usf.edu>, Richard Snyder <rsnyder@uwf.edu>
Cc: "Hogarth, Bill" <billhogarth@usf.edu>, "Ted.Switzer@myfwc.com" <Ted.Switzer@myfwc.com>, "Tom.Moore@noaa.gov" <Tom.Moore@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>, "Bob.McMichael@fwc.state.fl.us" <Bob.McMichael@fwc.state.fl.us>, Arthur Jonathan <Jonathan.Arthur@dep.state.fl.us>, "berry@fau.edu" <berry@fau.edu>, "drumbold@fgcu.edu" <drumbold@fgcu.edu>, Ellington William Ross <WEllington@admin.fsu.edu>, Felicia Coleman <coleman@bio.fsu.edu>, "heithaus@fiu.edu" <heithaus@fiu.edu>, "Jennifer.cherrier@famu.edu" <Jennifer.cherrier@famu.edu>, "morris@ncf.edu" <morris@ncf.edu>, "portner@rsmas.miami.edu" <portner@rsmas.miami.edu>, "pwelsh@unf.edu" <pwelsh@unf.edu>, "qwhite@ju.edu" <qwhite@ju.edu>, "radha.pyati@unf.edu" <radha.pyati@unf.edu>, "rcowen@rsmas.miami.edu" <rcowen@rsmas.miami.edu>, "Richard E. Dodge" <dodge@nova.edu>, "rpodemski@uwf.edu" <rpodemski@uwf.edu>, "shagen@mail.ucf.edu" <shagen@mail.ucf.edu>, "sjaishan@ufl.edu" <sjaishan@ufl.edu>, Aswani Volety <avolety@fgcu.edu>, Bill Hogarth <bill.hogarth@admin.usf.edu>, Donald Winter <dwinter@harris.com>, Eric Chassignet <echassignet@coaps.fsu.edu>, Graham Worthy <gworthy@mail.ucf.edu>, Ian Macdonald <imacdonald@fsu.edu>, Joseph Boyer <boyerj@fiu.edu>, Kumar Mahadevan <kumar@mote.org>, Manhar Dhanak <dhanak@fau.edu>, Michael Wade Kindel <mkindel1@fau.edu>, Mitchell Roffer <roffers@bellsouth.net>, Nick Shay <nshay@rsmas.miami.edu>, Peter Braza <pbraza@unf.edu>, Peter Sheng <pete@coastal.ufl.edu>, Peter Tatro <ptatro@hboi.edu>, Sandra Vargo <svargo@marine.usf.edu>, Steve Woll <swoll@weatherflow.com>, William Dewar <dewar@ocean.fsu.edu>, Wade Jeffrey <wjeffrey@uwf.edu>
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Checked by AVG - www.avg.com
Version: 8.5.437 / Virus Database: 271.1.1/2871 - Release Date: 05/13/10 06:26:00

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From: Daniel Hahn <Daniel.Hahn@noaa.gov>
Date: May 15, 2010 9:05:16 AM EDT
To: Debbie Payton <Debbie.Payton@noaa.gov>
Cc: Debra Simecek-Beatty <Debra.Simecek-Beatty@noaa.gov>, Jeff Lankford <Jeff.Lankford@noaa.gov>, Joshua Slater <Joshua.Slater@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>, Debbie French McCay <DFrenchMcCay@asascience.com>
Subject: DWH - Morning overflight information for Weatherbird cruise

If we get an update please relay it to Tom Moore - Try email (tom.moore@noaa.gov) and cell phone [redacted]. He'll relay the information to the vessel.

Debbie French currently thinks the oil will surface to the WNW. See below.

The currents at the Wellhead are very weak now, no longer to the east. See attached and below. The oil will be transported by the ESE winds to the WNW and NW. I think the Sipper sampling should be rotated to the W to N quadrant.
I hope all is going well on the cruise.
Deb

Thanks for all your help.
Dan

Debbie Payton wrote:

we got you covered. I've cc'd DSB, Jeff and Josh. Between them, they can coordinate who can do a morning overflight of the source area and see if they can determine the rise location.

Daniel Hahn wrote:

Regarding the timing, the Weatherbird II should be doing transects in the vicinity of the plume throughout the morning Saturday, May 15. They are overnighting outside the spill area and will be heading in somewhere around daybreak. If information can be conveyed quickly back from a morning overflight, that could be very useful, that is, if adjustments can be made the day of the spill in coordination with SIMOPS. Otherwise, Friday's overflights are going to provide the best information.

Thanks again for the help everyone.
Dan

Debbie Payton wrote:

Debbie,
you scooped my response (i was halfway through typing and keep getting pulled away). But, of course, you are correct. The oil is generally surfacing within 1-2 km from the source and within 3-4 hours (without injection), confirmed both by obs and modeling. today's obs have the oil surfacing to the ene, which makes sense given the rig and rov adcps. following is the website with the adcp measurements - some days there is quite a shear in the vertical. the NGOM model (which you now should have access to through CJ?) has been doing a pretty good job with subsurface currents as well.

we will make sure that in prep for Saturday an observer identifies the surfacing area tomorrow, then I would look at the ADCPs and modify the sampling plan based on those obs (if we know approx what time the vessel will be in the area, we can try and schedule the source overflight to coincide with that time to give better direction).

http://metocean.fugrogeos.com/bp

Debbie

Debbie French McCay wrote:

All,

From my analysis and modeling, the rising oil should be surfacing close to the release site and down-current. The ADCP at the wellhead generally shows weak currents (<0.2 kt) from 3900ft (deepest point sampled) to about 400 ft below the surface. The ADCP measurements at 315 and 210 ft below the water surface have shown eastward currents up to 0.7 kts the last few days, but are slowing now to < 0.2kts. These are the shallowest measurements available, but I am assuming they apply all the way to the surface (for lack of any other data). Early in the spill, surface (200-300ft) currents were also weak. May 5-7 they were to the south, May 7-10 to the SE, and recently to the E. All of this is based on transport by the currents as measured by ADCP 42916 deployed May 1 at the wellhead site.

We would like some confirmation of this model, so we can locate sampling in the rising plume. We need to get these samples to confirm droplet sizes and dissolved PAHs in that water, and the algorythms used to model such for the purposes of water column injury modeling.

The Ocean Imaging overflight interpretations have been very valuable for this analysis, and the ones we have compared seem to agree with this model of what is going on. Today we have the "Payne cruise" sampling 2km E of the Wellhead, and they are seeing some oil there. Tomorrow and Sat the Sipper cruise is sampling the area, and we are trying to place them downstream of (Fri) and in the plume (Sat). Next week we are working on a plan for more water sampling. Perhaps coordination of the Ocean Imaging overflights with these plans would do the trick. If we can confirm the model, we can follow the ADCP measurements to locate our sampling.

Thanks for your help.
Debbie

Deborah French McCay
Applied Science Associates, Inc. (ASA)
55 Village Square Drive
South Kingstown, RI 02879 USA
d.french.mccay@asascience.com
voc: [redacted] B6 Privacy

____
From: Daniel Hahn [Daniel.Hahn@noaa.gov]
Sent: Thursday, May 13, 2010 4:42 PM
To: frank.csulak
Cc: Debbie Payton; Lisa Dipinto; Ian J Zelo; Doug Helton; Glen Watabayashi; Bill Lehr; Debbie French McCay; Tom Moore; Stephanie Willis
Subject: Re: Need Help - Surfacing oil locaiton

Debbie Payton and others,
My understanding is that, for the time being, we have a pretty good

handle on where oil is coming to the surface (i.e. about 2 km to the E). The reason we were requesting air support is that this location shifts due to subsurface currents and that, at times, we didn't have good information about where the oil was surfacing. I understand the complications with seeing surfacing oil when there is lots of oil on the water.

The objective of the SIPPER cruise is to collect information on plankton assemblages in the vicinity of the rising plume, and potentially to examine droplet size in the rising plume. Thus, knowing where the plume is coming to the surface allows us to plan our transect locations in such a way that we have better probability of hitting the plume.

Any updates from the overflights tomorrow will help us confirm that our proposed plume transects, which are planned for Saturday, are in the right location and that the rising plume hasn't shifted. A photo with drilling rig as a reference is very helpful (like attached).

Thanks for your assistance in helping us pin down this information.
Dan

frank.csulak wrote:

> Dan, I am trying to address your request for overflight information. See email from Debbie Payton. Please address her questions. Frank
>
> Debbie Payton wrote:
>
>> The overflights are being coordinated in the field (I'm assuming at each CP?) In Seattle, we are giving direction to the NOAA observers and the Ocean Imaging and NASA imaging flights.
>> Identifying where the oil is surfacing is not a simple matter anymore, it was a bit easier at the beginning of the spill when there wasn't as much oil in the area. I expect only the helos may be able to determine where the oil is surfacing, and it might require quite a bit of searching to see if they can see bubbles or blossoming and coordinating with the modeling effort to know where to look. Initial estimates (without adding subsea dispersants) were that oil would surface in 3-4 hours within 1.5 miles of the source. Initial observations confirmed this and we haven't tried to confirm it since that I am aware of.
>>
>> What is the question we are trying to answer and how much effort is it worth? Is knowing within a given radius good enough? If this is an important question for someone, I expect we would need a dedicated platform each day to get this information. If we only need an approximate, then we can use the modeling to answer it.
>>
>> frank.csulak wrote:
>>
>>> Who is the POC for coordinating NOAA overflights? Received request from Dan Hahn, NOAA/ORR St. Pete for our response overflights on a daily basis to fly over the location where the oil is coming to the surface, document lat/long, take photo with a reference point contained in the photo. This request came in a couple of days ago.
>>> Frank

--
Daniel Hahn, Ph.D.

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National Oceanic and Atmospheric Administration
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263 13th Avenue South
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email: Daniel.Hahn@noaa.gov
Phone: (727) 551-5715
Fax: [redacted]
Cell: [redacted]

--
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Begin forwarded message:

From: Bill Allison <allison.billiam@gmail.com>
Date: May 16, 2010 10:52:13 AM EDT
To: coral-list coral-list <Coral-List@coral.aoml.noaa.gov>
Subject: [Coral-List] Fwd: Gulf Oil Spill, dispersants

A number of list members have suggested that the dispersants could be problematic and should be investigated. It is ironic and alarming that oil dispersants inimical to life are being used in unprecedented quantities to make the problem “go away”, that is, to make it invisible & coincidentally(?), to make the largely unknown causal chain of environmental harm much harder to trace. We now have visible oil + invisible oil + ~2,000,000 liters of toxic dispersants in the Gulf, and the meter is still running - apparently an order of magnitude faster than announced some days ago.

Although the formula of Corexit, the main dispersant being used is proprietary, an online search identified some important ingredients as:

- 2-butoxyethanol: organic solvent, toxic, said to kill most arthropods,

biodegradable*.

- sulfonic acid esters: common in many household products such as detergents & in sulfa drugs (anti-biologics) - toxic (add detergent to an aquarium & watch).

- propylene glycol: an alcohol used in many household products, readily biodegradable*.

*BIODEGRADABLE - sounds good BUT: it means that microrganisms break it down, consuming oxygen in the process. Propylene glycol which I suppose is the carrier and main component, is said to have a very high BOD. Add to this the BOD created by the decomposition of creatures large & small killed by oil & dispersants, and that of microbes feeding on the oil itself. There is speculation about whether the resultant emulsion will sink or float and an expectation that the whole mess will disperse and be diluted, so becoming even more invisible. Recall that many species of marine larvae travel in the near-surface few millimeters of the sea. Depending on the timing of spawning events and dispersal, might this have a negative impact on larval recruitment across a spectrum of marine life?

On the positive side (I'm kidding), Corexit is made in USA, the stock of the producer has appreciated, & the costs the whole clean-up bundle will be added to GNP (I'm not kidding). Is that an insane system or what?

--
____
Say what some poets will, Nature is not so much her own ever-sweet interpreter as the mere supplier of that cunning alphabet, whereby selecting and combining as he pleases, each man reads his own peculiar lesson according to his own peculiar mind and mood. (Herman Melville, 1852)

____
Coral-List mailing list
Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

Begin forwarded message:

From: Mark Luther <luther@marine.usf.edu>
Date: May 17, 2010 10:35:19 AM EDT
To: Debbie French McCay <DFrenchMcCay@asascience.com>
Cc: Tom Moore <Tom.Moore@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Ernst Peebles <epeebles@marine.usf.edu>, "Morrison, Geoff" <morrison@seakeepers.org>, Sherryl Gilbert <sgilbert@marine.usf.edu>, Jon Jarrell <jjarrell@ysi.com>, Brian Bendis <bbendis@ysi.com>, Scott Burghart <scott@marine.usf.edu>
Subject: **Re: automated sampling system for oil spill -- Weatherbird II**

hi debie -- sorry not to reply earlier. i was distracted on another matter that you are involved with as well. we are working with a turner designs sensor, the td 4100. the web site is:

http://www.oilinwatermonitors.com/content/index.php?option=com_content&view=article&id=58&Itemid=57

i've attached a workshop report on this class of sensors that might be helpful. i'll try to call you later.

mark

Debbie French McCay wrote:

> Thanks Mark for the update. Please keep us posted.
> Do you have some protocols for the sensor? Would need to work into a plan.
> Thanks,

> > Debbie
> > Deborah French McCay
> > Applied Science Associates, Inc. (ASA)
> > 55 Village Square Drive
> > South Kingstown, RI 02879 USA
> > d.french.mccay@asascience.com
> > voc: [redacted]
> > ____
> > From: Mark Luther [luther@marine.usf.edu]
> > Sent: Monday, May 10, 2010 9:55 AM
> > To: Debbie French McCay
> > Cc: Tom Moore; Daniel Hahn; Ernst Peebles; Morrison, Geoff; Sherryl Gilbert; Jon Jarrell; Brian Bendis; Scott Burghart
> > Subject: Re: automated sampling system for oil spill -- Weatherbird II
> > hi debbie -- ysi is checking on delivery schedule and costs for the
> > hydrocarbon sensor and time/costs to integrate the sensor into the
> > seakeeper system. it would take at least a week to get the sensor
> > delivered. it would be best if the installation on the weatherbird is
> > done here at our docks. right now, the intake for the seakeeper system
> > is blocked from the outside to keep oil out. it requires a diver to
> > remove the plug. i'll talk to ernst today about the weatherbird's
> > future plans.
> > thanks -- mark
> > Debbie French McCay wrote:
> > > The data would be very useful to map the oil plume in the water as Sipper samples. When could the system be ready?
> > >
> > > Thanks
> > >
> > > Deborah French McCay
> > > Applied Science Associates, Inc. (ASA)
> > > 55 Village Square Drive
> > > South Kingstown, RI 02879 USA
> > > d.french.mccay@asascience.com
> > > voc: [redacted]
> > > ____
> > > From: Tom Moore [Tom.Moore@noaa.gov]
> > > Sent: Friday, May 07, 2010 9:15 AM
> > > To: Mark Luther
> > > Cc: Debbie French McCay; Daniel Hahn; Ernst Peebles; Morrison, Geoff; Sherryl Gilbert; Jon Jarrell; Brian Bendis; Scott Burghart
> > > Subject: Re: automated sampling system for oil spill -- Weatherbird II
> > >
> > > The boat is going to be making a stop in Pensacola for a crew change and some HAZMAT Training on Monday. I am not sure what the logistics of install are but that is an option to consider if this data will be useful.
> > >
> > > Tom
> > >
> > > On May 6, 2010, at 11:19 PM, Mark Luther wrote:
> > >
> > > > hi debbie -- sorry i missed your call.
> > > >
> > > > there is not a hydrocarbon sensor on the weatherbird's seakeeper system at present. we could add such a sensor to the existing seakeeper system when the ship returns to st. petersburg. the present cruise was staged on such short notice that there was no time to obtain and install the new sensor. in fact, we had a diver plug the seakeeper intake before this cruise so that oil didn't foul the c/t and bio-optical sensors. i strongly suspect that there will be follow-on cruises that could make use of the augmented system. i've copied ernst peebles, who is our faculty ichtyoplankton person who is coordinating the cruises.
> > > >
> > > > we do not have the hydrocarbon sensors in hand at present but we can obtain them if there is sufficient interest. we do have

the seakeeper systems into which the hydrocarbon sensors can be integrated. the advantage of the seakeeper system is that it is modular and self-contained, including all pumping, water handling, anti-fouling, and data acquisition and telemetry systems.

i have meetings from 10 am to 1 pm tomorrow but will try to call before 10 or after 1.

thanks -- mark

Debbie French McCay wrote:

Mark,
Sorry to not be able to talk to you today. Eoin alerted me to your email tonight. (Note my email above -- I think you used my old one).
I definitely need to talk to you about this asap. We are doing modeling of the spill for the NRDA working for NOAA ORR. Right now the focus is on data collection for model input and validation. Tonight a ship is enroute to take water samples in the spill zone, but of course can only feasibly get 10s of samples in the 2-day cruise.
In addition, I am working with Dan Hahn and Tom Moore of NOAA (cc'd here) to plan a cruise sampling of ichthyoplankton in the spill zone area. (They will also do CTDs and other sampling.) That cruise is leg 2 of the Weatherbird II cruise that left yesterday. Now they are sampling on the FL shelf; Monday or Tues they are going to port in Pensacola to get supplies and gear. After that they go out to sample in the spill zone area.
You say a hydrocarbon sensor is already installed on the USF vessel, Weatherbird II. Is it possible to get this activated and sampling during the cruise next week? The ship is doing up and down sawtooth sampling of the upper layer and running it through a Sipper image analysis system to ID and count plankton (fish and others). Also to count and measure sizes of oil droplets. Transects to be in clean water (baseline) then in plume area.
Is this feasible? I'd also like to talk about other possibilities.
Please email a good time to talk. I am involved in providing info to the other cruise tomorrow, so another day on the phone. I will try calling in the morning.
Thanks
Debbie

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-----Original Message-----
From: Eoin Howlett Sent: Thursday, May 06, 2010 8:29 PM
To: Debbie French McCay
Subject: FW: automated sampling system for oil spill
I think Mark used wrong email for you.

From: Mark Luther [luther@marine.usf.edu]
Sent: Thursday, May 06, 2010 5:41 PM
To: Jim Jeansonne
Cc: 'Mark Luther'; Sherryl Gilbert; Morrison, Geoff; Brian Bendis; Jon Jarrell; Eoin Howlett; dfrench@appsci.com
Subject: automated sampling system for oil spill
Hi Jim -- As we discussed on the phone, we here at USF Marine Science and YSI's St. Petersburg office have several Seakeeper 1000 automated ocean data acquisition systems (see http://www.seakeepers.org/technology.php). These modular, integrated systems can be augmented with hydrocarbon sensors to be used to collect data on the distribution of oil from the present spill. One of these systems is already installed on the USF vessel, Weatherbird II, and another on the Manta from the Flower Garden Banks NMS. We have at least 6 other systems that could be installed on vessels of opportunity, from small skiffs to USCG cutters to offshore supply vessels. As they are modular and completely self-contained, installation is relatively quick and simple. the intake can tap into an existing vessel thru-hull fitting or seachest, or can be a hose on a boom over the side of a small boat. Data from the sensors can be displayed in real-time onboard the

vessel or can be telemetered to shore by satellite. We plan to put a hydrocarbon sensor on the Weatherbird's Seakeeper system when she returns to port. The other 6 systems are available for use on other vessels if NOAA has need of them. If NOAA is interested, I can provide a cost estimate for integration of the hydrocarbon sensor and for installation. YSI can manufacture additional systems if required. The best way to reach me is my cell - [redacted].
As always, we are happy to help in any way we can -- Mark
--

Mark E. Luther, PhD | Tel: (727)553-1528
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USF College of Marine Science | http://ompl.marine.usf.edu
140 Seventh Avenue South | "If we weren't all crazy we
St. Petersburg, FL 33701 | would go insane" -- J. Buffett

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140 Seventh Avenue South | "If we weren't all crazy we
St. Petersburg, FL 33701 | would go insane" -- J. Buffett

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell
--

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140 Seventh Avenue South | "If we weren't all crazy we
St. Petersburg, FL 33701 | would go insane" -- J. Buffett

ACT_WR08-... Sensors.pdf

Begin forwarded message:

From: DWHNRDA <dwhnrda@gmail.com>
Date: May 17, 2010 1:04:28 PM EDT
To: Amy.Horner@sol.doi.gov, bob.mcmichael@myfwc.com, buck.buchanan@dmr.ms.gov, charles.killebrew@la.gov,

chris.denson@dcnr.alabama.gov, chuck@envirostat.org, Daniel.Hahn@noaa.gov, david.armstrong@dcnr.alabama.gov, david.palandro@myfwc.com, dfrenchmccay@asascience.com, dpeter@wlf.la.gov, elaine_leslie@nps.gov, Eric.Hoffmayer@usm.edu, Gary.Fitzhugh@noaa.gov, gina.saizan@la.gov, greg_eckert@nps.gov, hblanchet@wlf.la.gov, hfinley@wlf.la.gov, irvin.jackson@dmr.ms.gov, jeff_duncan@nps.gov, john.a.quinlan@noaa.gov, John.Foret@noaa.gov, john.mareska@dcnr.alabama.gov, jrowe@asascience.com, Karolien.Debusschere@la.gov, kelly.brinkman@dcnr.alabama.gov, Kevin.Anson@dcnr.alabama.gov, Kristopher.Benson@noaa.gov, lawrence.mccarthy@la.gov, matt.hill@dmr.ms.gov, Mike_Beiser@deq.state.ms.us, mschroeder@asascience.com, mwood@wlf.la.gov, pbanks@wlf.la.gov, poneil@gsa.state.al.us, rbourgeois@wlf.la.gov, read.hendon@usm.edu, scott.phipps@dcnr.alabama.gov, sfinger@usgs.gov, Stephanie.Willis@noaa.gov, steve.geiger@myfwc.com, Thomas_Sinclair@fws.gov, tsoniat@uno.edu, will.brantley@dcnr.alabama.gov, 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todd.folse@la.gov, Tom.Minello@noaa.gov, Vladimir.Kosmynin@dep.state.fl.us, Warren.P.Lorentz@usace.army.mil, Brad_Segrest@deq.state.ms.us, charles.armbruster@la.gov, Gregg.Gitschlag@noaa.gov, Karl_Brown@nps.gov, richard.butgereit@em.myflorida.com, Ryan_Theel@fws.gov, sdarby@gsa.state.al.us, sebersole@gsa.state.al.us, shodge@fsu.edu, astratto@clam.mi.nmfs.gov, Bill.Goodwin@noaa.gov, colleen_charles@usgs.gov, Emma.Hickerson@noaa.gov, George.Schmahl@noaa.gov, janice.duquesnel@dep.state.fl.us, Jennifer.Moore@noaa.gov, joanna.walczak@dep.state.fl.us, Joe.Schittone@noaa.gov, John.Embesi@noaa.gov, Lauri.Maclaughlin@noaa.gov, Margaret.W.Miller@noaa.gov, rob.ruzicka@myfwc.com, Shay.Viehman@noaa.gov, Steve.Gittings@noaa.gov, Tom.Hourigan@noaa.gov, Tom.Moore@noaa.gov, buddy_goatcher@fws.gov, Carolyn_Marn@fws.gov, Cherry_Green@nps.gov, CHUCK.MCKINLEY@sol.doi.gov, chuck_hunter@fws.gov, Cynthia.J.Banks@usace.army.mil, Damian_Higgins@fws.gov, daniel_welsh@fws.gov, david.evers@briloon.org, deborah_rocque@fws.gov, eci@teleport.com, Heather.J.Theel@usace.army.mil, janet_whitlock@fws.gov, jeskec@usgs.gov, Joan.Browder@noaa.gov, Kenneth_Munney@fws.gov, keteles.kristen@epamail.epa.gov, kevin_reynolds@fws.gov, Kim_Trust@fws.gov, lcarver@wlf.la.gov, Margaret_Wild@nps.gov, Mildred.E.Lord@usace.army.mil, mseymour@wlf.la.gov, msw103@ra.msstate.edu, nancy.douglass@myfwc.com, nick.winstead@mmns.state.ms.us, oksana.lane@briloon.org, pete_tuttle@fws.gov, randy_wilson@fws.gov, robin.boughton@myfwc.com, Roger.Clay@dcnr.alabama.gov, roger_helm@fws.gov, sonny_bass@nps.gov, Terry.Doonan@MyFWC.com, Vernon_Byrd@fws.gov, victoria.vazquez@dep.state.fl.us, Carol Beidleman <Carol_Beidleman@nps.gov>, Andy.David@noaa.gov, Anthony.J.Bednar@usace.army.mil, Gustavo.E.Davico@usace.army.mil, joe_meiman@nps.gov, Laurie.Sullivan@noaa.gov, william.coppenger@dep.state.fl.us, Juan Ramirez <juanramirez@tdi-bi.com>, Tim Fitzpatrick <timothy.fitzpatrick@dep.state.fl.us>, dmurgulet@gsa.state.al.us, egraham@asascience.com, jcragan@asascience.com, mcook@gsa.state.al.us, Robert.A.Taylor@noaa.gov, roy_Irwin@nps.gov, Jim Payne <jrpayne@sbcglobal.net>, Shannon Gerardi <shannon.gerardi@dep.state.fl.us>, amy.king@dcnr.alabama.gov, Anthony.Dvarskas@noaa.gov, Benjamin_Simon@ios.doi.gov, benp@ext.msstate.edu, brooksc@doacs.state.fl.us, Bruce_Peacock@nps.gov, cdonovan@stratusconsulting.com, Christian_Crowley@ios.doi.gov, cwagner@stratusconsulting.com, dchapman@stratusconsulting.com, dlavergne@wlf.louisiana.gov, eenglish@stratusconsulting.com, ehorsch@stratusconsulting.com, elkoubi@la.gov, heather_best@nps.gov, Jim.Waters@noaa.gov, jisaacs@wlf.la.gov, karelsj@doacs.state.fl.us, Katherine.Pease@noaa.gov, Kristin_Skrabis@ios.doi.gov, Norman.Meade@noaa.gov, peter_grigelis@ios.doi.gov, phil.wieczynski@dep.state.fl.us, phillip.hinesley@dcnr.alabama.gov, Sherri_Fields@nps.gov, sweicksel@stratusconsulting.com, Tony.Penn@noaa.gov, tracy_wade@doh.state.fl.us, John Fruin <fruinj@doacs.state.fl.us>, Nick Stratis <nick.stratis@dep.state.fl.us>, Benjamin.Shorr@noaa.gov, beth.stys@myfwc.com, Brion.Cook@noaa.gov, cambridgegis@gmail.com, clewis@indecon.com, elena_robisch@nps.gov, Jill.Bodnar@noaa.gov, Jonathan.Watson@dep.state.fl.us, kathleen.okeife@myfwc.com, kdoiron@indecon.com, kknee@asascience.com, mark.barrett@myfwc.com, netre@indecon.com, tjavits@indecon.com, Valerie_Alley@deq.state.ms.us, Dan Hudgens <dhudgens@indecon.com>, Todd Goeks <Todd.Goeks@noaa.gov>
Subject: **Information Request - analytes for tissue samples**

Work Groups:

Simeon Hahn (Marine Mammals/Turtles TWG Lead) is requesting information on what analytes are being chosen for tissue samples with a specific request re: analytes related to dispersants. Please send all relevant information to him (cc'd here, simeon.hahn@noaa.gov) or to the gmail for forwarding.

Begin forwarded message:

From: DWHNRDA <dwhnrda@gmail.com>
Date: May 17, 2010 1:06:02 PM EDT
To: astratto@clam.mi.nmfs.gov, Bill.Goodwin@noaa.gov, colleen_charles@usgs.gov, Emma.Hickerson@noaa.gov, George.Schmahl@noaa.gov, janice.duquesnel@dep.state.fl.us, Jennifer.Moore@noaa.gov, joanna.walczak@dep.state.fl.us, Joe.Schittone@noaa.gov, John.Embesi@noaa.gov, karen_battle-sanborn@nps.gov, Lauri.Maclaughlin@noaa.gov, Margaret.W.Miller@noaa.gov, MaryElliott.Rolle@noaa.gov, patricia.cortelyou-hamilton@sol.doi.gov, rob.ruzicka@myfwc.com, Shay.Viehman@noaa.gov, Steve.Gittings@noaa.gov, Tom.Hourigan@noaa.gov, Tom.Moore@noaa.gov, rsjakubczak@gmail.com
Cc: Bill.Precht@noaa.gov
Subject: **Fwd: The Associated Press: Deep sea oil plumes, dispersants endanger reefs (FKNMS)**

Coral Group:

See forwarded email/article below.

http://www.google.com/hostednews/ap/article/ALeqM5hkizwl1juq5nw6XDJ9UTfq9bY0dwD9FOHA600

Deep sea oil plumes, dispersants endanger reefs
By JASON DEAREN and MATT SEDENSKY (AP) – 3 hours ago
NEW ORLEANS — The oil spill in the Gulf of Mexico has already spewed plumes over ecologically sensitive reefs, part of a stalled marine sanctuary proposal that would have restrict drilling in a large swath of the northern part of the vital waterway.
Marine scientists fear that two powerful Gulf currents will carry the oil to other reefs. The eastward flowing loop current could spread it about 450 miles to the Florida Keys, while the Louisiana coastal current could move the oil as far west as central Texas.
The depth of the gushing leaks and the use of more than 560,000 gallons of chemicals to disperse the oil, including unprecedented injections deep in the sea, have helped keep the crude beneath the sea surface. Marine scientists say diffusing and sinking the oil helps protect the surface species and the Gulf Coast shoreline but increases the chance of harming deep-sea reefs, which are seen as bellwethers for sea health.
"At first we had a lot of concern about surface animals like turtles, whales and dolphins," said Paul Montagna, a marine biologist at Texas A&M University Corpus Christi who studies Gulf reefs. "Now we're concerned about everything."
On Sunday, researchers said computer models show oil has already entered the loop current that could carry the toxic goo toward the Keys, the third-longest barrier reef in the world.
The oil is now over the western edge of a roughly 61-mile expanse of 300-to-500-foot-deep reef south of Louisiana known as the Pinnacles, about 25 miles north of where the Deepwater Horizon exploded April 20, killing 11 people and starting the spill that grows by the hour.
The Pinnacles is one of nine coral banks and hard-bottom areas stretching from Texas to Florida that the National Oceanic and Atmospheric Administration tried in 2008 to get designated a marine sanctuary called Islands in the Stream.
This sanctuary would have restricted fishing and oil drilling around the identified reef "islands." But the plan was put on hold after vehement objections from Republican lawmakers, fishermen and the oil industry.
Scientists have found undersea plumes of oil at the spill as much as 10 miles long, which are an unprecedented danger to the deep sea environment, said Samantha Joye, a professor of marine sciences at the University of Georgia.
These plumes are being eaten by microbes thousands of feet deep, which removes oxygen from the water.
"Deepwater coral are abundant on the sea floor in this part of the Gulf, and they need oxygen," said Joye, who was involved in the plume discovery. "Without it, they can't survive."
Experts say the well's depth and Friday's decision by the U.S. Environmental Protection Agency to allow BP to shoot massive amounts of dispersing chemicals deep underwater may help protect vital marshes and wetlands on the Gulf Coast. But the tradeoff may result in significant effects on more sea life.
Oil mixed with the chemical agent can disperse into the water more easily, rather than it staying on the surface, where it could bypass deeper banks like Pinnacles, said Edward Van Vleet, a chemical oceanography professor at the University of South Florida.
The downside is that it causes oil to sink, coating corals and other reef organisms and smothering them, he said.
When the dispersed oil is broken into smaller globules, he said they are more easily eaten by smaller reef organisms and can kill them or cause tumors or something else harmful.

Federal officials who oversee marine sanctuaries and fisheries say it's too early to tell how reefs and other important habitats may be damaged, said Dr. Jane Lubchenco, NOAA's undersecretary of commerce for oceans.
NOAA, which manages marine sanctuaries, is also responsible for estimating financial costs of the spill on the sea environment and fisheries. The Pinnacles is a significant habitat for sea life vital to commercial fisheries such as red snapper, crab and shrimp.
The creation of a sanctuary across hundreds of miles of the Gulf would not have blocked oil and gas exploration where the Deepwater Horizon exploded, said Montagna. However, he said it could have resulted in stricter environmental regulation for reefs closest to the spill site, and likely less drilling.
"So you can imagine these animals that make a living on rocks, filtering food out of the water, and the dispersants come along and sink the oil; it's a big concern," Montagna said.
The area also is breeding ground for sperm whales and bluefin tuna, species not doing well, he said.
Studies published in a 2005 National Academy of Sciences report show that oil mixed with dispersants damaged certain corals' reproduction and deformed their larvae. The study concluded the federal government needed to study more before using massive amounts of dispersants.
Reefs are made up of living creatures that excrete a hard calcium carbonate exoskeleton.
Depending on the oil exposure, they can be smothered by the pollutants or become more susceptible to bleaching, which hinders reproduction and growth. While the warm temperatures of Florida could speed the recovery of damaged reefs there, some problems could be seen for a decade or more. In the deeper reefs in colder water closer to the spill, the damage could last even longer.
As the spill increases, the oil oozes toward other reefs that stretch from the blowout site eastward to the Florida Keys National Marine Sanctuary.
The Keys exist in relatively shallow water, so the potential exposure to the oil is higher than for deeper reefs, though BP PLC officials say the oil would be more diffused after having broken down during its travel over hundreds of miles.
This week, researchers from USF and the Florida Department of Environmental Protection are heading to the loop current to get a "chemical fingerprint" of any oil they find to confirm it is from the leaking well.
"We don't expect the loop current to carry oil onto beaches," William Hogarth, dean of the University of South Florida's College of Marine Science, said. "But we do have a great concern for the Keys."
If oil reaches the Keys, it could threaten one of the country's greatest underwater natural resources as well as its tourism industry. Locals throughout the ribbon of islands not only relish their ties to the water but rely on it to help bring in 2 million visitors each year.
"They're not going to come if our beaches are tarred and our mangroves have died and it's a polluted dump," said Millard McCleary, program director of the Key West-based Reef Relief. "They'll go to the Bahamas or the Caymans or they'll go to Mexico."
/Sedensky reported from Key West, Fla. Associated Press writer Janet McConnaughey in New Orleans contributed to this report./

--

William F. Precht
Program Manager
Damage Assessment, Restoration and Resource Protection
NOAA - Florida Keys National Marine Sanctuary
P.O. Box 1083
95230 Overseas Highway
Key Largo, FL 33037
off: (305) 852-7717 x29
cell: [redacted]
email: Bill.Precht@noaa.gov
--
"The conservation of natural resources is the fundamental problem.
Unless we solve that problem it will avail us little to solve all others."
President Teddy Roosevelt, October 4, 1907

Begin forwarded message:

From: "Lisa.Vandiver" <Lisa.Vandiver@noaa.gov>
Date: May 17, 2010 1:27:54 PM EDT
To: Jean.Cowan@noaa.gov
Cc: Leslie Craig <Leslie.Craig@noaa.gov>, Roger B Griffis <Roger.B.Griffis@noaa.gov>, Daphne Macfarlan <Daphne.Macfarlan@noaa.gov>, Meg Goecker <Meg.Goecker@noaa.gov>, Cheryl Brodnax <Cheryl.Brodnax@noaa.gov>, Cecelia Linder <Cecelia.Linder@noaa.gov>, Marti McGuire <Marti.McGuire@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>
Subject: Re: DWH - Potential Restoration Project Options

Hi Jean-

That is a great point. I would think that this is where addressing the sources of nutrients that are contributing to the Dead Zone could play in to restoration (e.g., improving water quality). In addition, NOAA scientists in the Gulf Hypoxia Task Force have indicted that they are concerned about potential phosphorus loadings into the Gulf from the dispersants. The Gulf is P limited (in part, due to all the N discharged from the Mississippi River) and this addition of P may be enough to promote algal blooms and subsequently enhancing hypoxia occurrence. Just a thought.

Lisa

Jean.Cowan@noaa.gov wrote:

> Leslie,
> I don't have an answer to this, but I am wondering about restoration project ideas for the potentially massive water column injury in the middle of the Gulf. With the latest acknowledgment that oil is staying deeper in the water column and possibly getting swept up in the loop current, would this feasibly be scaled to coastal restoration project(s), such as marsh and oyster reef restoration? If so, for which state(s) if the injury is in the middle of the Gulf? Again, I have no specific answer, but wanted to put it out there for thought. In large part, this will be an evolving discussion as injury assessment moves along, but if we had some ideas of how we might handle it for restoration that would be good. Thanks,
> Jean
>
> ----- Original Message -----
> From: Leslie Craig <Leslie.Craig@noaa.gov>
> Date: Monday, May 17, 2010 8:02 am
> Subject: DWH - Potential Restoration Project Options
>
>> Hi all,
>> I think I have been in touch with most of you directly but perhaps this email will serve to get us all closer to the same page. One of the tasks I have been assigned is to pull together a list of "known" restoration options in the areas potentially affected by the DWH spill. Of course, this is only intended to be a first snap shot, based on multiple sources, of potential restoration options in the area. Below is an initial list of people who I hope to coordinate with to provide some feedback, in a pretty short time frame.
>>
>> *
>> I hope to have some feedback from the group by the end of this week (May 21)- and the bulk of information in hand by mid to late next week (May 26-28). My deadline to have something back to HQ is around June 1.*
>>
>> Leslie – Lead; FL Panhandle
>> Marti – West Coast FL (not yet - but may be soon); mapping of projects passed on from the rest of the group
>> Meg – MS, AL - start with ARRA unfunded projects; Mobile Bay NEP PrioritiesDaphne – ESA; marine mammals
>> Cece - LA & MS (based upon work from LA-MS Working Group)
>> Roger Griffis - CELP (land acquisition priorities for each state)
>> Cheryl - potentially ARRA unfunded projects; CWPPRA non-selected, BTNEP priorities (are these things Cece would already be covering?)
>> Lisa Vandiver - Non-point source, MS R Watershed
>>
>> I have attached a spreadsheet that we can all work from. Do not feel intimidated by all of the fields. The more you can fill in, the better - but just give me what you have or what makes sense for every project. Also, do not feel stifled by the word "PROJECT" - the things that make it on this list can also be Project concepts. For instance, if an NEP has identified a broad need, go ahead and fit it on the
>> list.
>>
>> Hopefully most of the fields are self explanatory but here are a few that might be confusing:

Column E: Correlation to injury - DO NOT WORRY ABOUT THIS FIELD, unless you really really want to. This is a field we will use to track how/if a particular project may compensate for a specific injury... i.e. A wetland creation project might have "Fishery biomass injury" listed in this column.
Column M: NOAA POC - this field is you and any other NOAA POC that is appropriate

The second attachment is a very DRAFT document that begins to describe the RC's role in Restoration Planning through the DARRP and specifically for this spill. This is NOT for distribution - it is also not rocket science!

Please feel free to call me with any questions. I have a crazy week but this is my priority so I will return emails and calls as soon as I can.
Thanks!
Leslie

--
Leslie Craig
NOAA Restoration Center
263 13th Avenue South
St. Petersburg, FL 33701
(Phone) [redacted]
(Fax) [redacted]

--

Lisa Vandiver
Knauss Sea Grant Fellow
NOAA Restoration Center 1315 East West Highway
Silver Spring, MD 20910
email: lisa.vandiver@noaa.gov
phone: [redacted]

Begin forwarded message:

From: Ed Blume <eblume2702@gmail.com>
Date: May 17, 2010 2:47:56 PM EDT
To: coral-list coral-list <Coral-List@coral.aoml.noaa.gov>
Subject: Re: [Coral-List] Fwd: Gulf Oil Spill, dispersants

Several posters described experiments to determine the impact of oil on coral. Has one done (or does anyone know of) research on the ingredients to Corexit, as described by BIll Allison?

Although the formula of Corexit, the main dispersant being used is proprietary, an online search identified some important ingredients as:

- 2-butoxyethanol: organic solvent, toxic, said to kill most arthropods, biodegradable.*

*- sulfonic acid esters: common in many household products such as detergents
& in sulfa drugs (anti-biologics) - toxic (add detergent to an aquarium & watch).*
- propylene glycol: an alcohol used in many household products, readily biodegradable.*
Ed Blume
Madison, WI
On Sun, May 16, 2010 at 9:52 AM, Bill Allison <allison.billiam@gmail.com>wrote:

A number of list members have suggested that the dispersants could be problematic and should be investigated. It is ironic and alarming that oil dispersants inimical to life are being used in unprecedented quantities to make the problem “go away”, that is, to make it invisible & coincidentally(?), to make the largely unknown causal chain of environmental
harm much harder to trace. We now have visible oil + invisible oil + ~2,000,000 liters of toxic dispersants in the Gulf, and the meter is still running - apparently an order of magnitude faster than announced some days ago.

Although the formula of Corexit, the main dispersant being used is proprietary, an online search identified some important ingredients as:

- 2-butoxyethanol: organic solvent, toxic, said to kill most arthropods, biodegradable*.

- sulfonic acid esters: common in many household products such as detergents
& in sulfa drugs (anti-biologics) - toxic (add detergent to an aquarium & watch).

- propylene glycol: an alcohol used in many household products, readily biodegradable*.

*BIODEGRADABLE - sounds good BUT: it means that microrganisms break it down,
consuming oxygen in the process. Propylene glycol which I suppose is the carrier and main component, is said to have a very high BOD. Add to this the
BOD created by the decomposition of creatures large & small killed by oil & dispersants, and that of microbes feeding on the oil itself. There is speculation about whether the resultant emulsion will sink or float and an expectation that the whole mess will disperse and be diluted, so becoming even more invisible. Recall that many species of marine larvae travel in the
near-surface few millimeters of the sea. Depending on the timing of spawning
events and dispersal, might this have a negative impact on larval recruitment across a spectrum of marine life?

On the positive side (I’m kidding), Corexit is made in USA, the stock of the
producer has appreciated, & the costs the whole clean-up bundle will be added to GNP (I’m not kidding). Is that an insane system or what?

--
____
Say what some poets will, Nature is not so much her own ever-sweet interpreter as the mere supplier of that cunning alphabet, whereby selecting
and combining as he pleases, each man reads his own peculiar lesson according to his own peculiar mind and mood. (Herman Melville, 1852)
____

Florida Keys National Marine Sanctuary (Upper Region)
P.O. Box 1083
Key Largo, FL 33037
[redacted] (cell) bill.goodwin@noaa.gov

From: Craig Downs [redacted]@hughes.net>
Date: May 18, 2010 9:43:59 AM EDT
To: 'John Halas' <John.Halas@noaa.gov>, 'Cheryl Woodley' <Cheryl.Woodley@noaa.gov>
Cc: 'John Fauth' <jfauth@mail.ucf.edu>, 'Scott Donahue' <Scott.Donahue@noaa.gov>, 'Bill Goodwin' <Bill.Goodwin@noaa.gov>, 'Bill Precht' <Bill.Precht@noaa.gov>
Subject: RE: response to oil spill?

Hey John,

Have you guys contacted/spoke with Gary Shigenaka at NOAA HAZMAT? He is good, experienced, and can give your team some sound advice. Also ask him for his review on oil/fuel impacts on coral reefs. Many effect-bets are off because of the use of dispersants.

And when you bring Gary Shigenaka on board, tell him that the "anti-christ" has been working for the past 12 days, and last Thursday the opposition had teams in the Keys.

Which you may also want to remind folks about permits requirements for collections in the FKNMS. I gave free advice to two firms that they may NOT want to collect anything in the FKNMS without first having permits...

Collections; will they follow chain of custody? You've got at least five different categories of legal actions. Some are much more stringent in the methodology for evidence collection. Best follow the most stringent, that way everything is covered.

My curiosity is of who you that has experience with oil spills and coral reefs/mangroves/forensic investigations. Anyone?

If sampling, make sure you don't use plastic, only Teflon or "clean glass." You've already got some folks down there looking for the tracer chems in the dispersants.

Helpful hint: make sure that divers are "lab-clean" between sampling dives. Cross-contamination follies by "the good guys" are already being noted by the opposition.

Let me know if you guys need any help.

Craig

Craig A. Downs Ph.D.
Executive Director

Haereticus Environmental Laboratory
A 501(c)(3) non-profit organization
P.O. Box 92

Clifford, Virginia 24533 U.S.A.
Phone: [redacted]
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Research Faculty
Office of Public Health Studies
John A. Burns School of Medicine
University of Hawai'i - Manoa
1960 East-West Road, BioMed Tower
Honolulu, Hawaii 96822 U.S.A.

Research Professor
Department of Environmental Studies
Sweet Briar College
134 Chapel Road
Sweet Briar, Virginia 24595 U.S.A

-----Original Message-----
From: John Halas [mailto:John.Halas@noaa.gov]
Sent: Monday, May 17, 2010 5:42 PM
To: Cheryl Woodley; Craig Downs
Cc: John Fauth; Scott Donahue; Bill Goodwin; Bill Precht
Subject: Re: response to oil spill?

Cheryl & Craig,

Brian's SE regional Sanctuaries Science Coordinator position is yet to be filled. Scott Donahue is still the acting Science Coordinator for FKNMS and heavily involved with conference calls and real busy planning for an FKNMS oil event along with Bill Goodwin for corals on the Damage Assessment Restoration and Research team with Bill Precht heading up the DARRP team.

On conference calls there have been some discussion on guidelines for sampling protocol with plans to take advantage of already scheduled trips to the Flower Gardens (today) and Tortugas. Litigation issues have also been brought up in relation to sampling.

In ccing Scott, Bill and Bill maybe they could chime in with further discussion on the possibility of NCCOS involvement and assistance.

Thanks for inquiring and offering the help.

John

Cheryl Woodley wrote:

> Hi John
> Craig, John and I have been exchanging emails about the possibility of the effects of the oil spill hitting FL. Is there a new science coordinator since Brian has passed away? Are there any samples being taken prior to the oil reaching the Keys? If it is of interest, we have some samples in our freezer from our past studies down there as well as biomarker data, that may be of value in determining effects. As I'm sure you know, the best would be to have samples just prior. Also just as a reminder, the biomarker technology is not limited to corals. Please let me know if we can be of any assistance.
> All the best
> Cheryl

--
John Halas
Florida Keys National Marine Sanctuary
Upper Region Manager
95230 Overseas Highway/P.O. Box 1083

Key Largo, FL 33037
Phone-[redacted] ext. 34
FAX-[redacted]

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 18, 2010 10:08:30 AM EDT
To: "Bill.Goodwin" <Bill.Goodwin@noaa.gov>
Cc: Mary Elliott Rolle <MaryElliott.Rolle@noaa.gov>, Steve Gittings <Steve.Gittings@noaa.gov>, Bill Precht <Bill.Precht@noaa.gov>
Subject: Re: [Fwd: Re: response to oil spill?]

I think it would be very valuable to bring Craig and Cheryl into this effort. They both have a lot of experience on the sub-leathal effects issues. Per our conversation yesterday I already left a voicemail for Cheryl Woodley (NOAA/NOS), but have yet to her back.

On May 18, 2010, at 9:57 AM, Bill.Goodwin wrote:

FYI

--
****
Bill Goodwin
Sanctuary Resources Manager
Florida Keys National Marine Sanctuary (Upper Region)
P.O. Box 1083
Key Largo, FL 33037
305-852-7717 x 28
[redacted] (cell) bill.goodwin@noaa.gov

From: Craig Downs [redacted]
Date: May 18, 2010 9:43:59 AM EDT
To: 'John Halas' <John.Halas@noaa.gov>, 'Cheryl Woodley' <Cheryl.Woodley@noaa.gov>
Cc: 'John Fauth' <jfauth@mail.ucf.edu>, 'Scott Donahue' <Scott.Donahue@noaa.gov>, 'Bill Goodwin' <Bill.Goodwin@noaa.gov>, 'Bill Precht' <Bill.Precht@noaa.gov>
Subject: RE: response to oil spill?

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Let me know if you guys need any help.

Craig

Craig A. Downs Ph.D.
Executive Director

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Research Professor
Department of Environmental Studies
Sweet Briar College
134 Chapel Road
Sweet Briar, Virginia 24595 U.S.A

-----Original Message-----
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Sent: Monday, May 17, 2010 5:42 PM
To: Cheryl Woodley; Craig Downs
Cc: John Fauth; Scott Donahue; Bill Goodwin; Bill Precht
Subject: Re: response to oil spill?

Cheryl & Craig,

Brian's SE regional Sanctuaries Science Coordinator position is yet to be filled. Scott Donahue is still the acting Science Coordinator for FKNMS and heavily involved with conference calls and real busy planning for an FKNMS oil event along with Bill Goodwin for corals on the Damage Assessment Restoration and Research team with Bill Precht heading up the DARRP team.

On conference calls there have been some discussion on guidelines for sampling protocol with plans to take advantage of already scheduled

trips to the Flower Gardens (today) and Tortugas. Litigation issues have also been brought up in relation to sampling.

In ccing Scott, Bill and Bill maybe they could chime in with further discussion on the possibility of NCCOS involvement and assistance.

Thanks for inquiring and offering the help.

John

Cheryl Woodley wrote:

> Hi John
> Craig, John and I have been exchanging emails about the possibility of the effects of the oil spill hitting FL. Is there a new science coordinator since Brian has passed away? Are there any samples being taken prior to the oil reaching the Keys? If it is of interest, we have some samples in our freezer from our past studies down there as well as biomarker data, that may be of value in determining effects. As I'm sure you know, the best would be to have samples just prior. Also just as a reminder, the biomarker technology is not limited to corals. Please let me know if we can be of any assistance.
> All the best
> Cheryl

--
John Halas
Florida Keys National Marine Sanctuary
Upper Region Manager
95230 Overseas Highway/P.O. Box 1083
Key Largo, FL 33037
Phone- [redacted] ext. 34
FAX- [redacted]

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

Begin forwarded message:

From: Cheryl Woodley <Cheryl.Woodley@noaa.gov>
Date: May 18, 2010 11:01:12 AM EDT
To: Tom Moore <Tom.Moore@noaa.gov>, Craig Downs <[redacted]@hughes.net>
Subject: **[Fwd: Re: response to oil spill?]**

Hi Tom
I got your call. I am forwarding you an email from Craig Downs. Gary he mentions has been through this and written the book on corals. Craig has already been approached by BP lawyers, so he has experience along these lines.

I tried your office, will try cell.

Cheryl

--
Cheryl Woodley, Ph.D.
Coral Health and Disease Program

DOC/NOAA/NOS/NCCOS
Center for Coastal Environmental Health and Biomolecular Research
Hollings Marine Laboratory
331 Fort Johnson Rd
Charleston, SC 29412
843.762.8862 Phone
[redacted] Fax
cheryl.woodley@noaa.gov

From: Craig Downs <[redacted]>
Date: May 18, 2010 9:43:59 AM EDT
To: 'John Halas' <John.Halas@noaa.gov>, 'Cheryl Woodley' <Cheryl.Woodley@noaa.gov>
Cc: 'John Fauth' <jfauth@mail.ucf.edu>, 'Scott Donahue' <Scott.Donahue@noaa.gov>, 'Bill Goodwin' <Bill.Goodwin@noaa.gov>, 'Bill Precht' <Bill.Precht@noaa.gov>
Subject: **RE: response to oil spill?**

Hey John,

Have you guys contacted/spoke with Gary Shigenaka at NOAA HAZMAT? He is good, experienced, and can give your team some sound advice. Also ask him for his review on oil/fuel impacts on coral reefs. Many effect-bets are off because of the use of dispersants.

And when you bring Gary Shigenaka on board, tell him that the "anti-christ" has been working for the past 12 days, and last Thursday the opposition had teams in the Keys.

Which you may also want to remind folks about permits requirements for collections in the FKNMS. I gave free advice to two firms that they may NOT want to collect anything in the FKNMS without first having permits...

Collections; will they follow chain of custody? You've got at least five different categories of legal actions. Some are much more stringent in the methodology for evidence collection. Best follow the most stringent, that way everything is covered.

My curiosity is of who you that has experience with oil spills and coral reefs/mangroves/forensic investigations. Anyone?

If sampling, make sure you don't use plastic, only Teflon or "clean glass." You've already got some folks down there looking for the tracer chems in the dispersants.

Helpful hint: make sure that divers are "lab-clean" between sampling dives. Cross-contamination follies by "the good guys" are already being noted by the opposition.

Let me know if you guys need any help.

Craig

Craig A. Downs Ph.D.

Executive Director

Haereticus Environmental Laboratory
A 501(c)(3) non-profit organization
P.O. Box 92

Clifford, Virginia 24533 U.S.A.
Phone: [redacted]
www.haereticus-lab.org

Research Faculty
Office of Public Health Studies
John A. Burns School of Medicine
University of Hawai'i - Manoa
1960 East-West Road, BioMed Tower
Honolulu, Hawaii 96822 U.S.A.

Research Professor
Department of Environmental Studies
Sweet Briar College
134 Chapel Road
Sweet Briar, Virginia 24595 U.S.A

-----Original Message-----
From: John Halas [mailto:John.Halas@noaa.gov]
Sent: Monday, May 17, 2010 5:42 PM
To: Cheryl Woodley; Craig Downs
Cc: John Fauth; Scott Donahue; Bill Goodwin; Bill Precht
Subject: Re: response to oil spill?

Cheryl & Craig,
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Thanks for inquiring and offering the help.

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Cheryl Woodley wrote:

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All the best
Cheryl

--
John Halas
Florida Keys National Marine Sanctuary
Upper Region Manager
95230 Overseas Highway/P.O. Box 1083
Key Largo, FL 33037
Phone-[redacted] ext. 34
FAX-[redacted]

Begin forwarded message:

From: Craig Downs [redacted]>
Date: May 18, 2010 1:06:16 PM EDT
To: 'Tom Moore' <Tom.Moore@noaa.gov>
Subject: **RE: craig**

Hi Tom,

Sure, I would be happy to help out in any way I can.

I can sign documents indicating that I have no conflict of interest, and both my organization (Haereticus) and I are not being retained by any other organization.

I have been working on oil-spills since 1999. I've worked with/for both U.S. federal agencies, as well as protecting the environmental liabilities of corporations. I basically run forensic investigations for natural resource damage events, and specialize on coral reefs. I've done a number of cases concerning crude oil, heavy marine fuels, as well as oil/dispersant issues concerning coral reefs (Panama, Colombia, Saudi Arabia, Israel, Yap, etc). I've done work both on impact assessments, as well as recovery assessments and modeling.

For sampling strategy, was wondering first about what your objectives will be concerning which legal actions you want to address. Does Counsel want to focus only on NRD/oil pollution act, or will they be including actions concerning ESA, etc?

Definitely, you want to account for the "Boehm" model of baseline. Capture sites before the impact, as well as establish reference sites to track recovery (similar to what was done post hoc for the Valdez oil spill).

For methods, I would definitely follow "clean" protocols, and make sure you address and document efforts against cross-contamination from one sampling site to another. Your opposition is already working that angle based on current efforts by NOAA/CG.

Sampling targets. I would definitely focus in on collecting coral and coral reef biopsies, but also recommend collecting surface sediment and porewater. This will allow you make repeated-measure tests of the same site/colony.

There is a concept called "manufactured uncertainty." You guys will come up against this, and my read of the playing field is that they will hit you hard with this.

Again, any way I can be of assistance, I would be enthusiastic to help.

Craig

Craig A. Downs Ph.D.
Executive Director

Haereticus Environmental Laboratory
A 501(c)(3) non-profit organization
P.O. Box 92

Clifford, Virginia 24533 U.S.A.
Phone: [redacted]
www.haereticus-lab.org

Research Faculty
Office of Public Health Studies
John A. Burns School of Medicine
University of Hawai'i - Manoa
1960 East-West Road, BioMed Tower
Honolulu, Hawaii 96822 U.S.A.

Research Professor
Department of Environmental Studies
Sweet Briar College
134 Chapel Road
Sweet Briar, Virginia 24595 U.S.A

-----Original Message-----
From: Tom Moore [mailto:Tom.Moore@noaa.gov]
Sent: Tuesday, May 18, 2010 12:06 PM
To: Craig Downs
Cc: Cheryl Woodley
Subject: Re: craig

Craig,

I spoke with Cheryl and if your interested we would like to look at the possibility of pulling you into this process on the Trustee side. If your able to get me a quick write-up on your background we can start getting the correct folks who make decisions engaged. Separately I would be interested in your initial thoughts on the best approach on a tiered sampling strategy that would be great.

Thanks
Tom

On May 18, 2010, at 11:49 AM, Cheryl Woodley wrote:

> Tom
> If you were trying to call Craig he called me right after we hung up, so you should be able to get him now.
> Cheryl
>
> Craig, Tom's number is [redacted]
>
> --
> Cheryl Woodley, Ph.D.
> Coral Health and Disease Program
>
> DOC/NOAA/NOS/NCCOS

Hi Tom,

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Craig

Craig A. Downs Ph.D.
Executive Director

Haereticus Environmental Laboratory
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P.O. Box 92

Clifford, Virginia 24533 U.S.A.
Phone: [redacted] B6 Privacy
www.haereticus-lab.org

Research Faculty
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1960 East-West Road, BioMed Tower
Honolulu, Hawaii 96822 U.S.A.

Research Professor

Department of Environmental Studies
Sweet Briar College
134 Chapel Road
Sweet Briar, Virginia 24595 U.S.A

=

Tom Moore
NOAA Restoration Center/DARRP
263 13th Ave South
St. Petersburg, Florida 33701

[redacted] Office
Cell

--
****
Bill Goodwin
Sanctuary Resources Manager
Florida Keys National Marine Sanctuary (Upper Region)
P.O. Box 1083
Key Largo, FL 33037
[redacted] (cell)
bill.goodwin@noaa.gov

Begin forwarded message:

[redacted]

[redacted]

Referral to USGS

[redacted] Referral to USGS

Begin forwarded message:

From: Cheryl Woodley <Cheryl.Woodley@noaa.gov>
Date: May 18, 2010 3:06:32 PM EDT
To: Ilsa B Kuffner <ikuffner@usgs.gov>
Cc: Tom Moore <Tom.Moore@noaa.gov>
Subject: **Re: Annotated bibliography - oil spill impacts**

Hi Ilsa
I was just invited to this call today by Tom Moore, so I don't have much background information on the sites they are discussing.
But here are a papers that may be of value related to effects and the use of cellular diagnostics.
Cheryl

Ilsa B Kuffner wrote:

> Primary literature on oil impacts to natural resources:
>
> Marine Science Review - 371
> Special edition: "Oil and oil spills: the Gulf of Mexico"
>
> http://www.seaweb.org/resources/documents/MSR_371SpecialEdition-Oilandoilspills.pdf
>
> **
> Ilsa B. Kuffner, Ph.D.
> Research Ecologist
> St. Petersburg Coastal and Marine Science Center
>
> US Geological Survey
> 600 4th Street South
> St. Petersburg, FL 33701
>
> Tel: (727) 803-8747 ext. 3048
> Fax: (727) 803-2030
> Email: ikuffner@usgs.gov
> https://profile.usgs.gov/ikuffner

--
Cheryl Woodley, Ph.D.
Coral Health and Disease Program

DOC/NOAA/NOS/NCCOS
Center for Coastal Environmental Health and Biomolecular Research
Hollings Marine Laboratory
331 Fort Johnson Rd
Charleston, SC 29412
843.762.8862 Phone
843.762.8737 Fax
cheryl.woodley@noaa.gov

valdez paper....pdf (76.2 KB)
Kyowa Violet....pdf (410 KB)
Ecotox 2010....pdf (526 KB)
Oil effects o....pdf (208 KB)
Begin forwarded message:

> **From:** DWHNRDA <dwhnrda@gmail.com>
> **Date:** May 18, 2010 3:15:17 PM EDT
> **To:** astratto@clam.mi.nmfs.gov, Bill.Goodwin@noaa.gov, Bill.Precht@noaa.gov, colleen_charles@usgs.gov, Dan.Dorfman@noaa.gov, Emma.Hickerson@noaa.gov, Fan.Tsao@noaa.gov, George.Schmahl@noaa.gov, Greg.Piniak@noaa.gov, Ilsa Kuffner <ikuffner@usgs.gov>, janice.duquesnel@dep.state.fl.us, Jennifer.Moore@noaa.gov, joanna.walczak@dep.state.fl.us, Joe.Schittone@noaa.gov, John.Embesi@noaa.gov, karen_battle-sanborn@nps.gov, Lauri.Maclaughlin@noaa.gov, Margaret.W.Miller@noaa.gov, MaryElliott.Rolle@noaa.gov, patricia.cortelyou-hamilton@sol.doi.gov, rob.ruzicka@myfwc.com, Shay.Viehman@noaa.gov, Stephen Blair <BlairS@miamidade.gov>, Steve.Gittings@noaa.gov, Tom.Hourigan@noaa.gov, Tom.Moore@noaa.gov
> **Subject: Coral Group - PDFS**
>
> Attached.
>
> --
>
> William F. Precht
> Program Manager
> Damage Assessment, Restoration and Resource Protection
> NOAA - Florida Keys National Marine Sanctuary
> P.O. Box 1083
> 95230 Overseas Highway
> Key Largo, FL 33037
> off: [redacted] B6 Privacy
> cell: [redacted] B6 Privacy
> email: Bill.Precht@noaa.gov
> --
> "The conservation of natural resources is the fundamental problem.
> Unless we solve that problem it will avail us little to solve all others."
> President Teddy Roosevelt, October 4, 1907

lin_oey_wan...s.pdf (2.0 MB)
Lugo-Fernan....pdf (1.4 MB)
Begin forwarded message:

> **From:** Aaron Hutchins <ahutchins@TNC.ORG>
> **Date:** May 18, 2010 3:35:38 PM EDT
> **To:** Caitlin Lustic <clustic@TNC.ORG>, restoration@frrp.org, James Byrne <jbyrne@TNC.ORG>, Meaghan Johnson <meaghan_johnson@TNC.ORG>, Chris Bergh <cbergh@TNC.ORG>, Kemit-Amon Lewis <klewis@TNC.ORG>, Daniel Green <dgreen@TNC.ORG>, Jonathan Brown <jonathan_brown@TNC.ORG>, Ron Sjoken <rsjoken@TNC.ORG>, Jennifer Greene <jgreene@TNC.ORG>, Robert Brumbaugh <rbrumbaugh@TNC.ORG>, Amanda Wrona <awrona@TNC.ORG>

Subject: **Re: [Restoration] Oil spill response call RESCHEDULE**

Last call for specific questions to raise with the Caribbean Regional Response Team tomorrow. We present the project at 9 am and will segway into the issue of actions we can take at the Keys nurseries now.

-Aaron

From: Caitlin Lustic
Sent: Tuesday, May 11, 2010 4:49 PM
To: Caitlin Lustic; restoration@frrp.org; James Byrne; Meaghan Johnson; Chris Bergh; Aaron Hutchins; Kemit-Amon Lewis; Daniel Green; Jonathan Brown; Ron Sjoken; Jennifer Greene; Robert Brumbaugh; Amanda Wrona
Subject: RE: Oil spill response call RESCHEDULE

Hi everyone –

Thanks to those who were able to make the call, and specifically Aaron for fielding our questions. Some of the questions that came up were:

How do we deal with the oil in the nurseries if it is in the form of tar balls or some other form of thick, sinking oil rather than a surface slick?

What will the effects of the dispersants be on the coral?

Is there anything we can do to protect the nursery corals?

Aaron and Kemit will be attending a meeting next week of the Caribbean Regional Response Team, and have offered to take our questions with them to see if they can get any more information. Many of the responders who would normally attend this meeting are likely in the Gulf helping out but it can't hurt to compile a list of questions and see what information we can get. **Please send me your questions by Monday, May 17.**

Some other important information:

Any expenses that you incur on the nursery project as a result of the oil spill (including time, additional equipment, etc.) can be paid under ARRA but should be very carefully documented. Please contact me if you have any questions about this.

James is currently doing some research into OSHA rules and requirements as they relate to diving in the presence of oil. We will get more details out soon, but there will be guidance about when it is safe to dive.

Please be very vigilant in monitoring for now so that we have accurate and recent data about the status of the nursery corals. Good baseline data could prove very important.

We will be in touch again as needed.

Thanks,

Caitlin

From: Caitlin Lustic
Sent: Thursday, May 06, 2010 9:19 AM
To: Caitlin Lustic; 'restoration@frrp.org'; James Byrne; Meaghan Johnson; Chris Bergh; Aaron Hutchins; Kemit-Amon Lewis; Daniel Green; Jonathan Brown; Ron Sjoken; Jennifer Greene; Robert Brumbaugh; Amanda Wrona
Subject: Oil spill response call RESCHEDULE

Since most everyone is going to be out on the water this Friday, let's reschedule for Tuesday at 4pm. Join us if you can.

Call-in number: [redacted]

Access code: [redacted]

Caitlin Lustic

From: Caitlin Lustic
Sent: Tuesday, May 04, 2010 9:19 AM
To: restoration@frrp.org; James Byrne; Meaghan Johnson; Chris Bergh; Aaron Hutchins; Kemit-Amon Lewis; Daniel Green; Jonathan Brown; Ron Sjoken
Subject: Oil spill response call - Friday 10am

Good morning everyone –

We would like to have a call this Friday at 10am to discuss potential oil spill response plans. I know this is late notice, so join us if you can, and I'll take and distribute meeting minutes for those who cannot. If you are unable to call in but have some thoughts you would like heard, give me a call or send me an email.

Thanks,

Caitlin

Call-in number: [redacted]

Access code: [redacted]

Document ID: 0.7.19.240

Caitlin Lustic
Coral Recovery Coordinator

clustic@tnc.org
[redacted] Ext. 114 (Phone)
(Fax)

nature.org

The Nature Conservancy
Florida Keys
P.O. Box 420237
Summerland Key, FL 33042

Shipping: 55 N. Johnson Rd.

Sugarloaf Key, FL 33042

Earth Day's 40th anniversary is April 22nd. Dive into our online community and join the celebration!

____
Restoration mailing list
Restoration@frrp.org
http://frrp.org/mailman/listinfo/restoration_frrp.org

Begin forwarded message:

From: "Robert H. Richmond" <richmond@hawaii.edu>
Date: May 18, 2010 6:33:21 PM EDT
To: coral-list@coral.aoml.noaa.gov
Subject: [Coral-List] Corexit oil dispersant and corals

In response to Ed Blume's and others' question on the effects of Corexit oil dispersant on corals, here is the summary from a Master's Thesis by a past graduate student of mine who performed some experiments on coral gametes and larvae:

MENDIOLA, W.J.C. 2004. The effect of the oil dispersant, Corexit 9527, on reproduction of the spawning coral, Acropora surcuosa, and on larval settlement and metamorphosis of the brooding coral, Pocillopora damicornis. 40 pages. [Thesis Advisor: R.H. Richmond].

Conclusions

The findings of this investigation clearly show that exposure to relatively realistic concentrations of Corexit 9527 may reduce fertilization in A. surculosa and reduce the larval settlement and metamorphosis of P. damicornis. One must keep in mind that these experiments were performed with dispersant only. During an actual oil spill, it is more likely that the larvae will be exposed to high amounts of dispersed oil rather than dispersant alone. As mentioned earlier, the effects of exposure to dispersed oil on many marine organisms is more damaging than oil or dispersant exposure alone. Epstein et al. (2000) found this to be true when testing six different oil dispersants (Inipol IP-90, Petrotech PTI-25, Bioreico R-93, Biosolve, and Emulgal C-100) on larvae of the coral, S. pistillata and Heteroxenia fuscescense. In an earlier study, Cook and Knap (1983) found that dispersed oil had a much more devastating effect on photosynthesis of the coral, D. strigosa than either the oil
or dispersant alone (decreasing photosynthesis by 85% when exposed to 1 ppm of Corexit 9527 for 8 h). Negri and Heyward (2000) noted similar findings with respect to fertilization and metamorphosis of A. millepora larvae.

The experiments in this study were used to determine the toxicity of Corexit 9527 alone on the corals, A. surculosa and P. damicornis. Further research is needed to determine the toxic effects of dispersed oil on these and other coral species through their life history stages. Armed with such data, environmental managers in this part of the world can better make informed decisions on whether to use this oil dispersant for oil spill clean up purposes.

Please feel free to contact me for more details.

Bob

Robert H. Richmond, Ph.D.
Research Professor
Kewalo Marine Laboratory
University of Hawaii at Manoa
41 Ahui Street
Honolulu, Hawaii 96813
Phone: [redacted]
Fax: [redacted]
E-mail: richmond@hawaii.edu
____
Coral-List mailing list
Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

Begin forwarded message:

From: Troy Baker <Troy.Baker@noaa.gov>
Date: May 18, 2010 8:34:14 PM EDT
To: Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Katherine Pease <Katherine.Pease@noaa.gov>, Craig R O'Connor <Craig.R.O'Connor@noaa.gov>, Rob Ricker <Rob.Ricker@noaa.gov>, Amy Merten <Amy.Merten@noaa.gov>, Tony Penn <Tony.Penn@noaa.gov>, Robert Haddad <Robert.Haddad@noaa.gov>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Jessica White <Jessica.White@noaa.gov>, Greg Baker <Greg.Baker@noaa.gov>, Jill Bodnar <Jill.Bodnar@noaa.gov>, Norman Meade <Norman.Meade@noaa.gov>, Anthony Dvarskas <Anthony.Dvarskas@noaa.gov>, George Graettinger <George.Graettinger@noaa.gov>, Brian Hostetter <Brian.Hostetter@noaa.gov>, Whitley Saumweber <Whitley.Saumweber@noaa.gov>, Marie Bundy <Marie.Bundy@noaa.gov>, Kristopher Benson <Kristopher.Benson@noaa.gov>, Kate Clark <Kate.Clark@noaa.gov>, Robert A Taylor <Robert.A.Taylor@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>, Lisa Dipinto <Lisa.Dipinto@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Kevin Kirsch <Kevin.Kirsch@noaa.gov>, Ian J Zelo <ian.j.zelo@noaa.gov>, MaryElliott Rolle <MaryElliott.Rolle@noaa.gov>, Benjamin Shorr <Benjamin.Shorr@noaa.gov>, Branden S Blum <Branden.S.Blum@noaa.gov>, Simeon Hahn <Simeon.Hahn@noaa.gov>, Tom Brosnan <Tom.Brosnan@noaa.gov>, Jay Field <Jay.Field@noaa.gov>, Todd Goeks <Todd.Goeks@noaa.gov>, George Graettinger <George.Graettinger@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>, John Cubit <John.Cubit@noaa.gov>
Subject: **Reminder about Protocols for Incident Email Correspondence**

[redacted]

[redacted]

Out of Scope

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

[redacted] Office
[redacted] Cell

--
John Cubit, Ph.D.
Regional Resource Coordinator, Southwest Region
NOAA Assessment and Restoration Division, Suite 4470
501 W. Ocean Blvd.
Long Beach, CA 90802
John.Cubit@noaa.gov
tel 562 980-4081; fax 562 980-4084
Cell phone (for urgent matters and travel contact) 562 810-4949

Begin forwarded message:

From: Bill Allison [redacted]@gmail.com>
Date: May 18, 2010 7:26:00 PM EDT
To: Ed Blume [redacted]@gmail.com>
Cc: coral-list coral-list <Coral-List@coral.aoml.noaa.gov>
Subject: **Re: [Coral-List] Fwd: Gulf Oil Spill, dispersants**

This newsletter just arrived a few minutes ago. It cites a number of publications relevant to your inquiry.

http://www.seaweb.org/news/oceanupdate.php

On Mon, May 17, 2010 at 2:47 PM, Ed Blume [redacted]@gmail.com> wrote:

> Several posters described experiments to determine the impact of oil on coral. Has one done (or does anyone know of) research on the ingredients to
> Corexit, as described by BIll Allison?
>
> *Although the formula of Corexit, the main dispersant being used is proprietary, an online search identified some important ingredients as:*
>
> *- 2-butoxyethanol: organic solvent, toxic, said to kill most arthropods, biodegradable*.*
>
> *- sulfonic acid esters: common in many household products such as detergents
> & in sulfa drugs (anti-biologics) - toxic (add detergent to an aquarium & watch).*
> *- propylene glycol: an alcohol used in many household products, readily biodegradable*.*
> Ed Blume
> Madison, WI
> On Sun, May 16, 2010 at 9:52 AM, Bill Allison <allison.billiam@gmail.com

wrote:

A number of list members have suggested that the dispersants could be
problematic and should be investigated. It is ironic and alarming that
oil
dispersants inimical to life are being used in unprecedented quantities
to
make the problem "go away", that is, to make it invisible &
coincidentally(?), to make the largely unknown causal chain of
environmental
harm much harder to trace. We now have visible oil + invisible oil +
~2,000,000 liters of toxic dispersants in the Gulf, and the meter is
still
running - apparently an order of magnitude faster than announced some
days
ago.

Although the formula of Corexit, the main dispersant being used is
proprietary, an online search identified some important ingredients as:

- 2-butoxyethanol: organic solvent, toxic, said to kill most arthropods,
biodegradable*.

- sulfonic acid esters: common in many household products such as
detergents
& in sulfa drugs (anti-biologics) - toxic (add detergent to an aquarium &
watch).

- propylene glycol: an alcohol used in many household products, readily
biodegradable*.

*BIODEGRADABLE - sounds good BUT: it means that microrganisms break it
down,
consuming oxygen in the process. Propylene glycol which I suppose is the
carrier and main component, is said to have a very high BOD. Add to this
the
BOD created by the decomposition of creatures large & small killed by oil
&
dispersants, and that of microbes feeding on the oil itself. There is
speculation about whether the resultant emulsion will sink or float and
an
expectation that the whole mess will disperse and be diluted, so becoming
even more invisible. Recall that many species of marine larvae travel in
the
near-surface few millimeters of the sea. Depending on the timing of
spawning
events and dispersal, might this have a negative impact on larval
recruitment across a spectrum of marine life?

On the positive side (I'm kidding), Corexit is made in USA, the stock of
the
producer has appreciated, & the costs the whole clean-up bundle will be
added to GNP (I'm not kidding). Is that an insane system or what?

--
____
Say what some poets will, Nature is not so much her own ever-sweet
interpreter as the mere supplier of that cunning alphabet, whereby

From: DWHNRDA <dwhnrda@gmail.com>
Date: May 19, 2010 10:50:10 AM EDT
To: astratto@clam.mi.nmfs.gov, Bill.Goodwin@noaa.gov, Bill.Precht@noaa.gov, colleen_charles@usgs.gov, Dan.Dorfman@noaa.gov, Emma.Hickerson@noaa.gov, Fan.Tsao@noaa.gov, George.Schmahl@noaa.gov, Greg.Piniak@noaa.gov, janice.duquesnel@dep.state.fl.us, Jennifer.Koss@noaa.gov, Jennifer.Moore@noaa.gov, joanna.walczak@dep.state.fl.us, Joe.Schittone@noaa.gov, John.Cubit@noaa.gov, John.Embesi@noaa.gov, karen_battle-sanborn@nps.gov, Lauri.Maclaughlin@noaa.gov, lcarver@wlf.la.gov, Margaret.W.Miller@noaa.gov, MaryElliott.Rolle@noaa.gov, patricia.cortelyou-hamilton@sol.doi.gov, rob.ruzicka@myfwc.com, Shay.Viehman@noaa.gov, Steve.Gittings@noaa.gov, Tom.Hourigan@noaa.gov, Tom.Moore@noaa.gov, Vladimir.Kosmynin@dep.state.fl.us, Cheryl Woodley <Cheryl.Woodley@noaa.gov>, Ilsa Kuffner <ikuffner@usgs.gov>, Stephen Blair <BlairS@miamidade.gov>, rsjakubczak@gmail.com
Subject: **Attn: Coral Group - dispersant lit**

Forwarded info for coral groups attached.

---------- Forwarded message ----------
From: <Bill.Goodwin@noaa.gov>
Date: Wed, May 19, 2010 at 6:43 AM
Subject: Please forward to coral group
To: DWHNRDA <dwhnrda@gmail.com>

Someone in the coral group had a question about this in yesterday's call. Thanks Joe Schittone.

---------- Forwarded message ----------
From: "Joe.Schittone" <Joe.Schittone@noaa.gov>
To: "Bill.Goodwin" <Bill.Goodwin@noaa.gov>
Date: Wed, 19 May 2010 06:58:58 -0400
Subject: Re: DWHNRDA Shallow Water Coral TWG conference call 5-18-10
Someone (don't remember who) asked about fish yesterday. Single best paper re fish attached.

Bill.Goodwin wrote:

> Thanks Joe. Really does look like spaghetti.
>
> Joe.Schittone wrote:
>
>> Bill, spaghetti plot of loop current drifters; from RSMAS. http://oceancurrents.rsmas.miami.edu/caribbean/spaghetti-bw/loop-current.jpg
>>
>> Bill.Goodwin wrote:
>>
>>> Thanks Joe. Amen to that. I just read this report the other day. You're right. may be some hard decisions.
>>>
>>> BG
>>>
>>> Joe.Schittone wrote:
>>>
>>>> Bill, saw BillP's email to group. Hope there's no doubt about dispersants! Only hard choice is if mangroves. Best review
>>>>
>>>> Joe.Schittone wrote:
>>>>
>>>>> Bill, this may be of use as early-warning indicator; shows detection of stress by PCR, rather than await physiologic indicia.
>>>>>
>>>>> Bill.Goodwin wrote:
>>>>>
>>>>>> :-(We'll miss you. I will keep you posted.
>>>>>>
>>>>>> BG
>>>>>>
>>>>>> Joe.Schittone wrote:

Bill, won't be able to make it. If as an outcome of call, you need any literature search, just write me.

Bill.Goodwin wrote:

> Hi folks.
>
> For those that haven't heard, the Coral TWG (Technical Working Group) has been subdivided into Deep and Shallow Water Coral subgroups. If you are receiving this message it is because you are on the Shallow Water Coral subgroup. If that needs to change, please let me know.
>
> Our first SWC subgroup call is scheduled for **Monday, 5-17-10 @ 1:30 CST / 2:30 EST**. Since we are somewhat behind the 8-ball in terms of developing a work plan (relative to the other TWG's that have been at this for a while now), I think we should convene every day this week and then see how we stand by the end of the week. We'll take notes at each meeting and send them out to the subgroup members each day.
>
> We have not been issued an "official" conference call # yet, but we will use this one until further notice:
>
> Dial in: **1-**[redacted]
> Pass Code:[redacted]
>
> Talk to you Monday.
>
> wbg
>
> --
> *************************
> Bill Goodwin
> Sanctuary Resources Manager
> Florida Keys National Marine Sanctuary (Upper Region)
> P.O. Box 1083
> Key Largo, FL 33037
> [redacted] (cell)
> bill.goodwin@noaa.gov

--
****
Bill Goodwin
Sanctuary Resources Manager
Florida Keys National Marine Sanctuary (Upper Region)
P.O. Box 1083
Key Largo, FL 33037
[redacted] (cell)
bill.goodwin@noaa.gov

--
****
Bill Goodwin
Sanctuary Resources Manager
Florida Keys National Marine Sanctuary (Upper Region)
P.O. Box 1083
Key Largo, FL 33037
[redacted] (cell)
bill.goodwin@noaa.gov

--
****
Bill Goodwin
Sanctuary Resources Manager
Florida Keys National Marine Sanctuary (Upper Region)
P.O. Box 1083
Key Largo, FL 33037
[redacted]
[redacted] (cell)
bill.goodwin@noaa.gov

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Ecotoxicology and Environmental Safety

http://www.elsevier.com/locate/ecoenv

Oil dispersant increases PAH uptake by fish exposed to crude oil

Shahunthala D. Ramachandran,[a] Peter V. Hodson,[a,*] Colin W. Khan,[a] and Ken Lee[b]

[a] School of Environmental Studies, Queen's University, Kingston, Ont., Canada K7L 3N6
[b] Department of Fisheries and Oceans, Bedford Institute of Oceanography, Centre for Offshore Oil and Gas Environmental Research, Halifax, NS, Canada B2Y 4A2

Received 14 May 2003; received in revised form 12 August 2003; accepted 25 August 2003

Abstract

The use of oil dispersants is a controversial countermeasure in the effort to minimize the impact of oil spills. The risk of ecological effects will depend on whether oil dispersion increases or decreases the exposure of aquatic species to the toxic components of oil. To evaluate whether fish would be exposed to more polycyclic aromatic hydrocarbon (PAH) in dispersed oil relative to equivalent amounts of the water-accommodated fraction (WAF), measurements were made of CYP1A induction in trout exposed to the dispersant (Corexit 9500), WAFs, and the chemically enhanced WAF (dispersant; CEWAF) of three crude oils. The crude oils comprised the higher viscosity Mesa and Terra Nova and the less viscous Scotian Light. Total petroleum hydrocarbon and PAH concentrations in the test media were determined to relate the observed CYP1A induction in trout to dissolved fractions of the crude oil. CYP1A induction was 6- to 1100-fold higher in CEWAF treatments than in WAF treatments, with Terra Nova having the greatest increase, followed by Mesa and Scotian Light. Mesa had the highest induction potential with the lowest EC_{50} values for both WAF and CEWAF. The dispersant Corexit was not an inducer and it did not appear to affect the permeability of the gill surface to known inducers such as β-napthoflavone. These experiments suggest that the use of oil dispersants will increase the exposure of fish to hydrocarbons in crude oil.

Keywords: Crude oils; Dispersant Corexit EC9500; CYP1A; EROD activity; Water-accommodated fraction

1. Introduction

Dispersants have been in use in oil spill clean-up since the 1950s. Chemical dispersion of oil in spill contingency exercises was not favored due to the toxicity of the early dispersant formulations to aquatic organisms. Laboratory studies of their observed toxicity (Linden, 1974; Hartwick et al., 1982; Carr and Linden, 1984) were further validated by field reports (Smith, 1968) from the Torrey Canyon and more recently the Sea Empress oil

et al., 2001), but in general less is known about the combined effects of oil and dispersants (Linden, 1975; Cohen et al., 2001; Gagnon and Holdway, 2000). Aquatic organisms are unlikely to be exposed to dispersant alone but instead to both dispersant and oil in combination, which may either exacerbate or mitigate toxic effects (Getter and Baca, 1984).

Dispersants are essentially surfactants comprising anionic and nonionic molecules in fixed ratios that render both hydrophilic and hydrophobic properties to

spills for which dispersants were used (Lewis and Aurand, 1997). However, many effective and less toxic dispersants have since been developed.

Risks to aquatic organisms from chemical dispersion could arise from exposure to the dispersant as well as to the dispersed oil. Much research has been conducted on the toxicity of dispersants (Nelson-Smith, 1977; Singer et al., 1993; Law, 1995; Carr and Linden, 1984; Cotou the dispersant. Their purpose is to orient at the oil–water interface and lower interfacial tension, thus facilitating the formation of small (<100 μm) mixed oil–surfactant micelles (Canevari, 1978). These oil emulsion droplets are driven into the water column forming a plume, thus breaking up the slick. The observed increased toxicity of dispersed (chemically or mechanically) oil has been attributed to particle size in dispersion (Bobra et al., 1989) and to aromatic hydrocarbon content (Anderson et al., 1974). The primary route of hydrocarbon uptake is via the gills

*Corresponding author. Fax: +1[redacted]
E-mail address: hodsonp@biology.queensu.ca (P.V. Hodson).

0147-6513/$ - see front matter © 2003 Published by Elsevier Inc.
doi:10.1016/j.ecoenv.2003.08.018

Begin forwarded message:

From: DWHNRDA <dwhnrda@gmail.com>
Date: May 19, 2010 10:54:51 AM EDT
To: astratto@clam.mi.nmfs.gov, Bill.Goodwin@noaa.gov, Bill.Precht@noaa.gov, colleen_charles@usgs.gov, Dan.Dorfman@noaa.gov, Emma.Hickerson@noaa.gov, Fan.Tsao@noaa.gov, George.Schmahl@noaa.gov, Greg.Piniak@noaa.gov, janice.duquesnel@dep.state.fl.us, Jennifer.Koss@noaa.gov, Jennifer.Moore@noaa.gov, joanna.walczak@dep.state.fl.us, Joe.Schittone@noaa.gov, John.Cubit@noaa.gov, John.Embesi@noaa.gov, karen_battle-sanborn@nps.gov, Lauri.Maclaughlin@noaa.gov, lcarver@wlf.la.gov, Margaret.W.Miller@noaa.gov, MaryElliott.Rolle@noaa.gov, patricia.cortelyou-hamilton@sol.doi.gov, rob.ruzicka@myfwc.com, Shay.Viehman@noaa.gov, Steve.Gittings@noaa.gov, Tom.Hourigan@noaa.gov, Tom.Moore@noaa.gov, Vladimir.Kosmynin@dep.state.fl.us, Cheryl Woodley <Cheryl.Woodley@noaa.gov>, Ilsa Kuffner <ikuffner@usgs.gov>, Stephen Blair <BlairS@miamidade.gov>
Subject: Fwd: Dispersant expert

Forwarded information for Coral groups is attached.

Patricia - please let me know if you'd like these attachments posted to the group's FTP site folder.

---------- Forwarded message ----------
From: **Cortelyou-Hamilton, Patricia** <Patricia.Cortelyou-Hamilton@sol.doi.gov>
Date: Wed, May 19, 2010 at 7:36 AM
Subject: FW: Dispersant expert
To: "DWHNRDA@gmail.com" <DWHNRDA@gmail.com>

Please send this to all members of the coral group.

Trish Cortelyou-Hamilton
Attorney-Adviser
U.S. Department of the Interior
Office of the Regional Solicitor
75 Spring Street, S.W., Room 304
Atlanta, Georgia 30303
Phone: [redacted] ext. 229
Fax: [redacted]
Email: patricia.cortelyou-hamilton@sol.doi.gov

From: Michael J Hooper [mhooper@usgs.gov]
Sent: Tuesday, May 18, 2010 11:29 AM
To: Cortelyou-Hamilton, Patricia
Subject: RE: Dispersant expert

[redacted]

Document ID: 0.7.19.240

[redacted]

Refer to USGS

Hope this helps.

Mike

From: "Cortelyou-Hamilton, Patricia" <Patricia.Cortelyou-Hamilton@sol.doi.gov>
To: "Hooper, Michael J" <mhooper@usgs.gov>
Date: 05/18/2010 06:22 AM
Subject: RE: Dispersant expert

[redacted]

Refer to DOI

From: Michael J Hooper [mailto:mhooper@usgs.gov]
Sent: Monday, May 17, 2010 9:37 PM
To: Carlucci, John
Cc: Horner, Amy; McKinley, Charles; Deal, Harriet; Toussaint, Lisa; Cortelyou-Hamilton, Patricia; Finger, Susan E
Subject: Dispersant expert

[redacted]

Refer to USGS

4245 Meyer Hall
[redacted] (office)
Email: rstjeerdema@ucdavis.edu

lab web site:
http://www.envtox.ucdavis.edu/tjeerdema/

____
Mike Hooper
USGS Columbia Environmental Research Center
4200 E New Haven Rd
Columbia, MO 65201
mhooper@usgs.gov

[redacted] Phone
Cell

References 2....pdf (207 KB)

Toxicology 1....pdf (471 KB)

CoralReefIm...net-2005.pdf

CoralOilDisp...pdf (93.8 KB)

Begin forwarded message:

From: Ed Blume [redacted]@gmail.com>
Date: May 19, 2010 10:37:14 AM EDT
To: Bill Allison [redacted]@gmail.com>
Cc: coral-list coral-list <Coral-List@coral.aoml.noaa.gov>
Subject: Re: [Coral-List] Fwd: Gulf Oil Spill, dispersants

Thanks for the references, Bill.

As of this morning, NOAA reports that over 590,000 gallons of dispersants have been spread in the gulf.

Ed Blume
Madison, WI

On Tue, May 18, 2010 at 6:26 PM, Bill Allison <allison.billiam@gmail.com>wrote:

> This newsletter just arrived a few minutes ago. It cites a number of publications relevant to your inquiry.
>
> http://www.seaweb.org/news/oceanupdate.php
>
> On Mon, May 17, 2010 at 2:47 PM, Ed Blume <eblume2702@gmail.com> wrote:

Several posters described experiments to determine the impact of oil on
coral. Has one done (or does anyone know of) research on the ingredients
to
Corexit, as described by BIll Allison?

*Although the formula of Corexit, the main dispersant being used is
proprietary, an online search identified some important ingredients as:*

*- 2-butoxyethanol: organic solvent, toxic, said to kill most arthropods,
biodegradable*.*

*- sulfonic acid esters: common in many household products such as
detergents
& in sulfa drugs (anti-biologics) - toxic (add detergent to an aquarium &
watch).*
*- propylene glycol: an alcohol used in many household products, readily
biodegradable*.*
Ed Blume
Madison, WI
On Sun, May 16, 2010 at 9:52 AM, Bill Allison [redacted]@gmail.com
wrote:

A number of list members have suggested that the dispersants could be
problematic and should be investigated. It is ironic and alarming that
oil
dispersants inimical to life are being used in unprecedented quantities
to
make the problem "go away", that is, to make it invisible &
coincidentally(?), to make the largely unknown causal chain of
environmental
harm much harder to trace. We now have visible oil + invisible oil +
~2,000,000 liters of toxic dispersants in the Gulf, and the meter is
still
running - apparently an order of magnitude faster than announced some
days
ago.

Although the formula of Corexit, the main dispersant being used is
proprietary, an online search identified some important ingredients as:

- 2-butoxyethanol: organic solvent, toxic, said to kill most arthropods,
biodegradable*.

- sulfonic acid esters: common in many household products such as
detergents
& in sulfa drugs (anti-biologics) - toxic (add detergent to an aquarium
&
watch).

- propylene glycol: an alcohol used in many household products, readily
biodegradable*.

*BIODEGRADABLE - sounds good BUT: it means that microrganisms break it
down,
consuming oxygen in the process. Propylene glycol which I suppose is the
carrier and main component, is said to have a very high BOD. Add to this
the
BOD created by the decomposition of creatures large & small killed by
oil &
dispersants, and that of microbes feeding on the oil itself. There is
speculation about whether the resultant emulsion will sink or float and
an

expectation that the whole mess will disperse and be diluted, so becoming
even more invisible. Recall that many species of marine larvae travel in the
near-surface few millimeters of the sea. Depending on the timing of spawning
events and dispersal, might this have a negative impact on larval recruitment across a spectrum of marine life?

On the positive side (I'm kidding), Corexit is made in USA, the stock of the
producer has appreciated, & the costs the whole clean-up bundle will be added to GNP (I'm not kidding). Is that an insane system or what?

--
____
Say what some poets will, Nature is not so much her own ever-sweet interpreter as the mere supplier of that cunning alphabet, whereby selecting
and combining as he pleases, each man reads his own peculiar lesson according to his own peculiar mind and mood. (Herman Melville, 1852)

____
Coral-List mailing list
Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

____
Coral-List mailing list
Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

--
____
"reality leaves a lot to the imagination..." John Lennon

____
Coral-List mailing list
Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

Begin forwarded message:

From: Eugene Shinn <eshinn@marine.usf.edu>
Date: May 19, 2010 9:34:55 AM EDT
To: coral-list@coral.aoml.noaa.gov
Subject: **[Coral-List] Corexit oil dispersant and corals**

Dear Bob, Its important to know what kind of oil was used for the dispersant experiment. Processed oil such as that often spilled by ships and tankers is more toxic than crude oil. If processed oiil was used in these experiments then the results have little application to the problem we face in the Gulf. There is one another damaging ingredient in dispersants that has not been mentioned. Hydrousdioxide..in excess it can cause big problems. Gene
--

March-May 2010

FROM THE DESK OF THE PROGRAM MANAGER

This issue, I'd like to touch on some global reef-related updates and share a little bad news tempered with some good news. We'll start with the bad news. Despite the best efforts of supporters and sponsors, proposals to list red and pink corals, as well as several shark species and Atlantic bluefin tuna, were all rejected during the voting process at the 15th Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Conference of the Parties (CoP) in March. While each proposal earned a simple majority of votes, none of them met the two-thirds majority requirement that is part of the CoP operating principles. This disappointing resolution means that none of these species have gained increased protection against the threats posed by current international trade. See the 'Special Feature' section for more details.

Despite the disappointing outcomes of CoP 15, a large step was made towards conserving the Chagos Archipelago, the largest coral atoll in the world. These 55 islands are a British Indian Ocean Territory and form a nearly pristine archipelago in the middle of the Indian Ocean. On April 1, British Foreign Secretary, David Milliband, designated the Chagos Archipelago as the largest marine protected are in the world. The fully protected marine reserve contains 210,000 square miles (544,000 square kilometers), an area twice the size of the United Kingdom. All extractive activities, such as industrial fishing and deep sea mining, are prohibited. To learn more, read the British Foreign & Commonwealth Office's press release or visit the Chagos Conservation Trust.

In the hot news department, we all are closely monitoring the events in the Gulf of Mexico. Our thoughts go out to our Gulf partners during this potentially disastrous environmental event.

-Kacky

SPECIAL FEATURES

Oil Spills and Corals. In response to recent concerned interest about oil spill impacts on corals and coral reefs, NOAA has put together a fact sheet of general information on coral values, impacts to coral from oil and dispersants, modes of potential exposure, response strategies, and data from some past oil spill events. This information has been provided by multiple NOAA sources and primarily pulls from "Oil Spills in Coral Reefs: Planning and Response Considerations," a 2001 report summarizing relevant research for spill response decision makers. The information appears on the Coral Reef Conservation Program's Web site as a Featured Story. While no impacts to corals have yet been reported, the information now presented online addresses concerns and questions directed to NOAA in recent weeks as the Deepwater Horizon spill persists. To see the latest on specific response actions and impacts from this oil spill, click here.

CITES Vote Falls Short for Corals and Sharks. The 15th Conference of the Parties (CoP) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) met in Doha, Qatar from March 13-25. While there were several marine species proposals submitted this year (the family Coralliidae, five shark species, and Atlantic bluefin tuna), unfortunately, none of the proposals were accepted. Below is a summary of the US-sponsored proposals and their outcomes.

Red and Pink Corals For the second time, the 175 nations participating in CITES failed to gather enough votes to implement increased protections for red and pink corals. No countries currently have comprehensive management plans for these coral species and a CITES listing would have encouraged nations to develop these plans. In 2007 at the 14th CoP, the US had proposed listing *Corallium* species under Appendix-II. The proposal was initially adopted but then reopened for debate during the plenary session and narrowly defeated. This year, the US and Sweden (on behalf of the European Union) together submitted a proposal to provide greater protection to all species of the genera *Corallium* and *Paracorallium* (approximately 31 described species and several undescribed species) by listing them under CITES Appendix-II. Had it been successful, the proposal would have limited trade of red and pink coral to legally and sustainably harvested coral and coral products. Although the proposal received a simple majority of votes, it did not receive the two-thirds majority needed for adoption (64 votes in support, 59 votes in opposition, and 10 abstentions).

Jewelry and carved artwork made from red and pink coral have a prominent place in Mediterranean and other cultures. Found mainly in the seas of the Mediterranean and Pacific, these corals have been harvested for centuries; however with the development of technologies like SCUBA and remotely operated vehicles, coral beds that had previously been inaccessible are now being exploited at a faster rate than their populations can sustain. Increasing evidence is also showing that all corals, including Coralliidae, are vulnerable to the effects of climate change and warming ocean temperatures appear to be having a

detrimental effect. These corals have many qualities that make them particularly vulnerable to over-exploitation. They are slow-growing, have long life spans, they are attached to the seafloor and are not mobile, and they take many years to reach reproductive maturity. Studies have shown that trade is having an adverse impact on red and pink corals' ability to maintain healthy populations and to reproduce. Since the 1980s, red and pink coral gardens have decreased in size, structure, and overall number of polyps by more than 60-70 percent.

Hammerhead and Oceanic Whitetip Sharks The US and Palau introduced two proposals to list several species of hammerhead sharks and the oceanic whitetip shark under Appendix II of CITES to ensure that the international trade of these highly threatened species is legal and sustainable.

The three sharks included in the first US/Palau proposal were the scalloped hammerhead, great hammerhead, and smooth hammerhead. The US had amended this proposal to remove the sandbar shark and dusky shark. Although the proposal gained a simple majority, it did not receive the two-thirds majority needed for adoption (75 votes in favor, 45 votes in opposition, and 14 abstentions). Since the vote was close, a decision was made by the US to reintroduce the hammerhead proposal for another vote. Once again, the proposal garnered a simple majority but failed to acquire the two-thirds majority needed for adoption (76 votes in favor, 53 votes in opposition, and 14 abstentions). The second proposal submitted by the United States and cosponsored by Palau was for the listing of the oceanic whitetip shark. The US amended this proposal to delay implementation for 24 months. Although the proposal received a simple majority, it also did not receive the two-thirds majority required for adoption (75 votes in favor, 51 votes in opposition, and 16 abstentions).

US Coral Triangle Initiative Launched. Recognized as the global center of marine biological diversity, the Coral Triangle is a geographic area encompassing almost 6 million km^2 of ocean and coastal waters in Southeast Asia and the Western Pacific. Within the Exclusive Economic Zones of six nations – Indonesia, Malaysia, Papua New Guinea, the Philippines, Timor Leste, and the Solomon Islands (CT6) – the region is home to some 363 million people, one-third of whom are directly dependent on coastal and marine resources for their livelihoods. The Coral Triangle is at immediate risk from a range of factors, including: unsustainable fishing, land-based sources of pollution, and climate change. To ensure long-term food security and to safeguard the region's extraordinary marine and coastal resources, in August 2007, Indonesian President Yudhoyono proposed the creation of the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI), a multilateral partnership among CT6 countries. Twenty-one heads of state, including President Bush, welcomed the Initiative at the Asia-Pacific Economic Cooperation (APEC) Summit in September 2007. The CTI was officially launched in December 2007 during the 13th Conference of the Parties to the UN Framework Convention on Climate Change in Bali. Reaching a major milestone in May 2009, the CTI's six heads of state signed the declaration launching the CTI and endorsed the Regional Plan of Action for the CTI.

The US Agency for International Development and the US Department of State are supporting the CTI with a $40 million, five-year program implemented by NOAA, a consortium of nongovernmental organizations, and a Program Integrator. Collectively, this team is called the United States Coral Triangle Initiative Support Team (US CTI). NOAA, as one of the key partners in the US Coral Triangle Initiative Support Program, serves as the US government agency providing technical assistance, and scientific and management capacity to the six Coral Triangle countries. The CRCP coordinates NOAA's involvement in the US CTI. NOAA activities include technical support and capacity building in: marine protected areas (MPA); climate change adaptation; and ecosystem approaches to fisheries management (including illegal, unreported and unregulated fisheries (IUU), highly migratory fisheries observer programs, and live reef food fish trade). In example, NOAA will be training national level experts on coastal climate adaptation planning, enhancing management capacity of municipal level MPA managers, and the training of trainers to institutionalize training and curriculum. NOAA is also cooperating closely with the International Monitoring, Control and Surveillance Network, as well as other domestic and international partners, to develop regional activities to address IUU fishing in the CT region. NOAA will provide assistance to Indonesia in developing its early action plan for Climate Change Adaptation and develop capacity on tools to implement the early action plan.

February 2010 marked a significant milestone in the US CTI, when, after nearly two years of planning, the Consolidated Work Plan for the US CTI Support Program was finalized, marking the official launch of the program.

ANNOUNCEMENTS

Applications Requested to Fill Immediate Opening for a Coral Reef Management Fellow in Florida. I.M. Systems Group, a contractor to NOAA's CRCP, is seeking an individual to serve as a Coral Reef Management Fellow for Florida's Department of Environmental Protection as part of the Coral Reef Management Fellowship Program. The Fellowship position, which is based in Miami, Florida, will begin as soon as the selected candidate is available, and will end in January 2012. To apply, click here and follow the instructions outlined in the posted statement of work. The statement of work also includes an overview of the goals, duties, and qualifications for the position. Applications will be accepted until the position is filled.

CHOW 2010: Clean Energy and a Healthy Ocean: Navigating the Future. As the premier ocean-focused conference held annually in Washington, DC, Capitol Hill Ocean Week (CHOW) brings together Members of Congress and Congressional staff;

federal, state and local government institutions; and experts from industry, academia, and the nonprofit community in an effort to shape marine policy discussions and incite lively conversation about current ocean and coastal issues. Held in conjunction with World Oceans Day and anchored by the National Marine Sanctuary Foundation's annual Leadership Awards Dinner, CHOW provides ocean policy professionals with unique opportunities to advance marine policy goals and interact with peers in the nation's capital.

CHOW 2010 will focus on the intersection between ocean and energy issues, including the ocean's diverse abilities to supply energy through current and emerging technologies and the myriad ways in which energy production and consumption affect the ocean. Click the link above to see the agenda and additional information.

Keep the Sea Free of Marine Debris Children's Art Contest. Between Earth Day and June 1, NOAA's Marine Debris Program is running an art contest for students currently in Grades K-8. Titled 'Keep the Sea Free of Marine Debris,' the contest asks children to illustrate how marine debris affects them and what they are doing about it. For more details, instructions, and entry form, click here. Winning artwork will be featured on the Marine Debris Program Website, newsletter, and in a 2011 calendar/planner.

Petition to List Bumphead Parrotfish Under the ESA. On April 2, NOAA's National Marine Fisheries Service (NMFS) announced a positive 90-day finding for a petition from WildEarth Guardians to list Bumphead Parrotfish as Threatened or Endangered under the Endangered Species Act (ESA). The petitioner also requested that critical habitat be designated for this species concurrent with listing under the ESA. The petition asserts that overfishing is a significant threat to the bumphead parrotfish and that this species is declining across its range and is nearly eliminated from many areas. The petition also asserts that degradation of its coral habitat through coral bleaching and ocean acidification is a threat to this species, as coral is its primary food source.

The positive 90-day finding means that the petition listed enough substantial scientific or commercial information indicating that the petitioned actions may be warranted for NOAA to initiate a comprehensive status review of the best available scientific and commercial information for the species. Subsequently, a call for additional scientific and commercial information on the species was requested by May 3. NMFS has one year to complete the review and deliver a final finding for Bumphead Parrotfish. It should be noted that because the full status review is more comprehensive than the 90-day review, the 'may be warranted' finding in April does not guarantee that the species will be listed under the ESA. For full details, download the Federal Register Notice (Vol. 75, No. 63, pp 1671316716, *pdf 60 kb*).

New Coral Ecosystem Data RSS Feed. NOAA's Coral Reef Information System (CoRIS) is the repository for all data and products generated by the CRCP. In response to multiple requests from data providers and site users, CoRIS has made metadata records and publications recently posted in its catalogs more easily discoverable on the CoRIS Website. CoRIS has developed and launched a Coral Ecosystem Data Really Simple Syndication (RSS) feed. The RSS feed is a dynamic listing of the 50 most recently updated metadata records in the CoRIS repository. It is updated daily and is the first of three RSS feeds CoRIS will be developing. Visitors to the CoRIS Website can subscribe to the Coral Ecosystem Data RSS feed or simply view the listing. The feed is also accessible from the CoRIS homepage. User feedback is welcomed. Please send all questions and comments to coris.metadata@noaa.gov.

Launch of New Website Provides Access to Global Socioeconomic Information. The Global Socioeconomic Monitoring Initiative for Coastal Management (SocMon) works through regional and local partners to facilitate community-based socioeconomic monitoring. Household and community-level data are collected to inform a particular population's dependence on coral reef resources and their perceptions of resource conditions, threats to marine and coastal resources, and support for marine management strategies such as marine protected areas. To date, over 60 assessments have been completed in 30 countries; the majority of these reports have been funded through the NOAA International Coral Reef Conservation Grants. SocMon fills a critical need by advancing a global and regional understanding of human interactions with, and dependence upon, coastal resources. This information can be used by coastal managers to modify their activities to achieve more effective management. SocMon is coordinated and primarily funded through NOAA. On March 31, SocMon launched a redesigned Website that is hosted by ReefBase. One major improvement found on the new site is the inclusion of access to the new SocMon database. The database has access to all of the SocMon site reports completed to date. The database is searchable by location, author, monitoring purpose, and other fields. The redesigned site also includes interactive maps depicting work done at specific sites around the world and improved access to SocMon data, publications, and images.

UPDATES FROM HEADQUARTERS

NOAA Celebrates Earth Week at Coral Restoration Sites. In celebration of Earth Week, NOAA Administrator Dr. Jane Lubchenco, NOS Assistant Administrator (acting) David Kennedy and others visited the Florida Keys National Marine Sanctuary to highlight coral reef restoration projects that are employing local people.

NOAA also celebrated at eight of the 50 coastal and habitat restoration projects funded through the American Recovery and Reinvestment Act of 2009, including two coral reef restoration projects:

· Threatened Coral Reef Recovery and Restoration, Florida Keys. NOAA was able to quickly hire people collect, rear, and ultimately transplant genetically diverse nursery-grown coral fragments to help replenish 34 degraded reefs in eight distinct areas of coral reefs in the Florida Keys and the US Virgin Islands

· Maunalua Bay Reef Restoration Project, Maunalua Bay, Hawai`i. Mudweed is smothering shallow reef flats, killing off coral and native seagrass meadows. The effort will restore coral reefs through manual removal of invasive alien algae from 22 acres of nearshore waters

Recovery Act efforts are helping to jump-start the nation's economy by supporting thousands of jobs as well as restore fish and wildlife habitat that people often take for granted. Not only do reefs play a critical role as habitat, they are also an integral part the economy. Reef-related expenditures generate billions of dollars in sales in U.S. coral reef regions annually. Learn more by reading the feature stories on the NOAA and CRCP Websites.

CRCP Educational Tools Shared During National Educators' Conference. The CRCP participated in the Climate Change symposium at the National Science Teacher Association's (NSTA) 2010 national conference in Philadelphia, PA from March 17-19. The half-day symposium brought together experts in climate change and education from various NOAA programs and the University of Texas. The CRCP sponsored nearly 80 educators in attendance by covering their symposium registration fee. The symposium covered global climate change; sea level rise; and bleaching and ocean acidification and coral reefs. A separate stand-alone presentation on corals and climate change was also well attended, with over 50 educators. NOAA had one of the most heavily trafficked booths at the conference, with many NOAA Teacher at Sea alumni present to talk to fellow educators. CRCP products were also present at the booth, including a coral ecosystem food web poster, coral educational CD, and the debut of the new Project WET "Discover Coral Reefs" activity booklet. In addition, NOAA Administrator and former university professor, Dr. Lubchenco, gave a plenary presentation that included several demonstrations related to teaching ocean science.

UPDATES FROM THE ATLANTIC/CARIBBEAN REGION

Cruise Assesses MPA Effectiveness in Restoring Seven Fish Species. The NOAA Fisheries Panama City Laboratory conducted a CRCP-funded cruise aboard the *M/V Spree* to several marine protected areas (MPAs) off the coasts of Florida and South Carolina from May 2-10. The goals of the cruise were to determine the presence and abundance (if present) of the seven reef fish species for which the MPAs were established to protect and to inform the South Atlantic Fishery Management Council of any changes in the fish assemblages over the past year. This mission is part of a project to characterize the resources of the South Atlantic Bight (SAB) closed areas and monitor the performance of the MPAs pre- and post-closure. Results from the cruise will help determine how effective the MPAs are in protecting the seven fish species. This project is also documenting the proliferation, spread, and ecosystem dynamics of invasive lionfish in the South Atlantic Bight.

Due to the water depths involved, a remotely operated vehicle (ROV) from the University of North Carolina at Wilmington was used to survey known and suspected areas of high relief habitat. Fifteen ROV dives were planned and seventeen were completed. Two collaborators from Harbor Branch Oceanographic Institution / Cooperative Institute for Ocean Exploration, Research & Technology also participated to assist with invertebrate identification and collect data for a separate NOAA-sponsored mesophotic coral project. Detailed analyses of the surveys and data on fish assemblages will follow in the months ahead. Other notable information collected include the observation of recreational fishing in some of the closed areas and data suggesting that invasive lionfish abundance is less than in previous years.

Mapping of BUIS Shows Shallow-water Topography for Ecosystem Management. A cross-agency team of scientists from

NOAA's Center for Coastal Monitoring and Assessment, in cooperation with the NOAA Chesapeake Bay Office, and the National Park Service (NPS), collected acoustic imagery describing the depth and physical properties of shallow-water habitats in Buck Island Reef National Monument (BUIS). These images were collected using a multibeam sound navigation and ranging sensor well suited for mapping marine environments between 5 and 75 m in depth. Mapping conducted on this mission fills in a critical information gap about the topography of BUIS's shallow-water areas. The 20 km^2 of imagery collected will be combined with previously collected imagery to create a seamless habitat map of the entire marine protected area. This final habitat map will be used by local NPS managers as a baseline for resource assessments, as a guide for present and future biological monitoring efforts, and as a tool to support spatially-explicit ecosystem management decisions.

Coral Reef Fish-Habitat Modeling to Support Fisheries and Ecosystem Management. A successful interagency workshop was held on May 4th at the University of Miami's (UM) Rosenstiel School of Marine and Atmospheric Science to showcase the capabilities of the CRCP-funded Reef Visual Census Program (RVC), a reef fish monitoring program that supports fisheries management. The joint UM and NOAA program collects primarily fisheries data, along with some habitat data; it has already been adopted by the National Park Service in Florida.

The objectives of the workshop were to bring together management clients with scientists to discuss new reef fish-habitat utilization modeling capabilities, management implications and applications of these new modeling capabilities, and specific scientific products that would best fulfill management needs. Participants included seventeen scientists and mangers from Federal, State, and local organizations, including representatives from NOAA, NPS, the state of Florida, the US Fish and Wildlife Service, and the Gulf of Mexico Fishery Management Council. The workshop focused on management of Florida's coral reef resources, but included broader applications to the US Caribbean and Pacific. This workshop provided a direct line of communication between scientists and managers, allowing communication of the capabilities and products of the RVC from scientists to managers, and feedback regarding specific management needs from managers to scientists.

Deep-sea Coral Cruise to Inform Fisheries Management. From April 8-14, researchers aboard the NOAA Ship *Pisces* explored deep-sea coral habitats off the southeastern United States, including on the continental slope east of Gray's Reef National Marine Sanctuary, in depths from 200-600 meters (650-2000 feet). The rugged bottom topography and the coral mounds in this region are attractive for deep-sea reef fish like wreckfish and blackbelly rosefish. In addition, large barrelfish and red bream shelter in the rugged bottom and coral mounds, and are thought to forage up in the water column at night. Wreckfish support an important and well-managed fishery off the coast of Georgia and South Carolina, and small amounts of barrelfish, red bream, blackbelly rosefish and other species are incidentally caught and landed in the wreckfish and other deepwater fisheries. In addition to the wreckfish fishery, the continental slope off the southeastern US is a trap fishery for golden crab and a trawl fishery for royal red shrimp. These fishing gears have potential to damage the fragile coral habitat where fish, crabs, shrimp and other animals live. In order to better manage the fisheries and their habitat for sustainable catches, more scientific information is needed regarding where the corals are found and how the harvested animals are associated with those corals.

The results of the research expedition, which employed the ME-70 fishery acoustic system to map fish distribution and abundance, combined with similar historical and future efforts, will result in mapping of high density coral areas and allowable fishing zones that minimize impacts on the habitat in which many important fish species live. Researchers also collected sediment samples and coral fragments with a remotely-operated vehicle (ROV). These samples will be used to evaluate man-made contaminants in these deep coral areas and to test a new isotopic aging technique. In spite of marginal weather conditions and uncommonly high currents, numerous ROV dives were made which provided approximately 15 hours of high resolution video imagery and over four gigabytes of still imagery. For ship photos and crew blogs please visit the mission's Website.

Researchers from two NOAA Fisheries Science Centers, NOAA's Ocean Service, NOAA's Office of National Marine Sanctuaries, the University of Alabama, and the College of Charleston participated in this cruise, sponsored by NOAA's Deep Sea Coral Program. This project was greatly aided by the participation of a deep ROV team from the Southwest Fishery Science Center in La Jolla, CA.

Seafloor Mapping Mission in the USVI. Scientists from NOAA's National Centers for Coastal Ocean Science (NCCOS) and partners completed a seafloor mapping mission off the southern coasts of St. Thomas and St. John in the US Virgin Islands (USVI). The scientists discovered an unexpectedly vast area of high coral cover southwest of St. Thomas, and several schools of relatively rare groupers and snappers at spawning aggregation sites at the shelf edge. The team also spotted roughly 26 derelict fishing traps on the seafloor, as well as coral formations entangled by marine debris.

During the 20-day mission, March 18-April 6, aboard the NOAA Ship *Nancy Foster*, the team used various SONAR technologies and a remotely operated vehicle to better understand the physical characteristics of the seafloor, locate and explore important seafloor habitats, and study fish populations and distributions at suspected spawning aggregation sites. The data collected will paint a much clearer picture of the USVI's underwater habitats and the animals and plants inhabiting them. Local scientists and managers in the USVI can then use these data sets to make informed ecosystem-based management decisions to protect, conserve, and sustainably manage these marine resources. This expedition marks the seventh year of the project and included several outreach events attended by local students, partners and political representatives. The mission was led by NCCOS with support from the CRCP and the Caribbean Fishery Management Council. For more details, see the mission overview and daily logs.

Reef Connectivity Cruise in the USVI. On March 15, the NOAA Southeast Fisheries Science Center's (SEFSC) Early Life History Team completed the first leg of this year's US Virgin Islands (USVI) reef fish connectivity cruise, extended to include the coral reef ledges/banks around St. Croix and the south coast of USVI ecosystem. The results of the cruise will help explain how circulation patterns in the area affect local and regional transport as well as retention of ecologically and economically important reef fish species.

The team deployed several satellite-tracked drifters to follow the paths of circulation patterns. The team also completed dive operations to deploy substrate-mounted acoustic Doppler current profilers in the passages to the east of St. Thomas, between Vieques and Culebra, and between Culebra and St. Thomas to help determine long-term regional flow/transport patterns.

This year the circulation of the area was dominated by a southward flow from the Atlantic into the Caribbean, resulting in atypical flow patterns and easterly currents around St. Croix and south of St Thomas. By contrast, in previous years average circulation was from east to west, then to the northeast through Virgin Passage into the Atlantic. The data collected by the team will help determine whether this is a typical flow pattern for this time of year or simply variance in the average flow. However, early analysis appears to indicate that the net result is transport to the east away from the Buck Island marine protected area toward Saba Bank, a local fishing area for the Leeward Islands. In addition, there appears to be a weak gyre formed between St Thomas and St. Croix which may provide for larval reef fish retention.

This fisheries oceanography research cruise was a NOAA collaboration between NOAA Fisheries SEFSC and the Office of Oceanic and Atmospheric Research's Atlantic Oceanographic and Meteorological Laboratory. Students from the University of the Virgin Islands (UVI) and the University of Miami participated as well as a researcher from UVI.

USVI Law Enforcement Training. On March 9-10, NOAA Fisheries Caribbean Field Office conducted training workshops with officers from the US Virgin Islands (USVI) Department of Planning and Natural Resources' Division of Environmental Enforcement. A NOAA Office of Law Enforcement agent trained USVI officers in evidence collection techniques and Caribbean Field Office staff provided participants with information regarding identification of listed species, managed fishery species, and marine habitats. The training is part of a project funded by the CRCP to create a guide for USVI law enforcement officers entitled: *Regulations & Biology of Marine Ecosystems in U.S. Virgin Islands: A guide for law enforcement officers*. The purpose of this type of training and the guide is to promote the conservation of coastal and marine resources by informing law enforcement officials about the biology and importance of these resources and the reason laws and regulations exist for their protection. Such educational tools for law enforcement help them more effectively complete their duties and assist them in educating the public about regulations during their outreach or intervention activities.

Reef Fish Spawning Aggregation Research in the Florida Keys. Field work was conducted during the first week of March in support of the reef fish spawning aggregation project in the Florida Keys. NOAA Southeast Fisheries Science Center researchers, in close coordination with researchers and managers from NOAA Center for Coastal Fisheries and Habitat Research, the Florida Keys National Marine Sanctuary, and the Florida Fish and Wildlife Conservation Commission are continuing work in the Keys focusing on reef fish aggregation sites. The purpose of the research is twofold: to characterize potential similarities in aggregation site geomorphological characteristics, with a goal of identifying geomorphological "signatures" that could be used to identify other potential aggregation sites; and to determine the extent to which fish are currently utilizing these sites. Some of these sites were reported by commercial fishers to have been "fished out" decades ago.

Mapping work, completed in previous years at upper Keys sites, is underway at sites off Key West. Surveys utilizing split-beam acoustics and scuba divers in 2009 indicated positive signs of aggregating snapper species at several upper Keys sites, and winter surveys are in progress at several upper Keys sites to assess potential grouper utilization. Acoustic and diver surveys for the lower Keys sites are planned for this summer.

UPDATES FROM THE PACIFIC REGION

Coral Ecosystem Conditions in American Samoa from 2010 ASRAMP Observations. The 2010 Coral Reef Ecosystem Division Reef Assessment and Monitoring Program (RAMP) cruise to American Samoa and the Pacific Remote Islands Areas

provide valuable updates on the conditions of Central Pacific coral reef ecosystems. In late February and March the cruise visited all islands of American Samoa and South Bank. At Rose Atoll, the lasting effects of a 1993 shipwreck can still be seen in the coral reef ecosystem, with up to 50 percent less coralline algae than in other parts of the atoll and only 1percent coral cover in the immediate area of the wreck, despite the removal of major portions of the rusting vessel by the US Fish and Wildlife Service. However, overall there were no immediately obvious changes at Rose this year compared to previous RAMP surveys in 2008.

At the request of local agencies, South Bank, a popular fishing area 37 miles south of Tutuila, was mapped using the NOAA Ship *Hi`ialakai's*. multibeam sonar systems; the resulting maps show that South Bank is a sunken coral atoll surrounded by a submerged barrier reef. These maps also enabled divers to conduct Rapid Ecological Assessment and towed-diver surveys, resulting in observations of a scoured rubble surface with low coral cover.

At Ta'u Island, RAMP divers revisited some of the world's largest ancient *Porites* coral formations—one measures 7 m in height and 41 m in circumference! Along the north side of Ta'u Island there has been a dramatic increase in the same invasive tunicate that was recorded at in high levels at Swains Island during the 2008 RAMP cruise. Upon returning to Swains, surveys revealed that the tunicate is no longer present in invasive amounts and the benthic cover has changed to crustose coralline algae. At a site on northeast Ta'u, two survey teams recorded the presence of a 6 ft Giant Grouper. On northwest Tutuila, divers reported a rare sighting of a 4ft-long Whitespotted Guitarfish.

This cruise marked the fifth biennial RAMP surveys to provide an on-going overview of coral reef ecosystem conditions in American Samoa and included six weeks of work in the territory. On-going monitoring of coral reef ecosystems provides a continuous record of how coral ecosystems change over time and how they respond to various stressors and changing environmental conditions.

Post-Tsunami Report on Coral Ecosystem Conditions in American Samoa. On September 29, 2009 a devastating tsunami struck American Samoa and neighboring islands. The deadly waves killed more than 170 people, caused severe property damage, and swept villages out to sea. In addition, they deposited a great deal of debris on the reefs in the territory; marine debris can cause damage to reefs as it is moved around by waves and currents. In December 2009, as part of a marine debris project, NOAA's Coral Reef Ecosystem Division (CRED) marine debris personnel participated in post-tsunami surveys in the waters around the island of Tutuila, helping to remove 8000 lbs. of debris from the coral reefs, and identifying 253 additional targets for later marine debris removal.

The 2010 Reef Assessment and Monitoring Program (RAMP) cruise to American Samoa provided an opportunity to observe any continued impacts to the territory's coral reefs five months after the tsunami. Towed divers specifically noted any evidence of coral reef damage caused by the tsunami during their surveys at 40-60ft depth around several of the territory's islands. The condition of the reefs around Tutuila was observed to be good with little evidence of tsunami impacts; coral damage in surveyed areas appeared minor overall. Some evidence of damage was seen on all sides of the island; however, localized areas of damage were most often observed just offshore of the villages on the southwest, west, and northwest coasts. Localized areas of coral damage consisting of overturned *Acropora* tables and broken/scattered plating colonies were noted, including one instance of a large *Porites* colony that had been toppled by tsunami waves but was still alive. No noticeable damage attributable to the tsunami was recorded by the benthic towed-divers around the other islands of the territory visited during this cruise.

This cruise marked the fifth biennial RAMP surveys to provide an on-going overview of coral reef ecosystem conditions in American Samoa and included six weeks of work in the territory. On-going monitoring of coral reef ecosystems provides a continuous record of how coral ecosystems change over time and how they respond to stressors, such as tsunami-related damage.

2010 RAMP Cruise Results from PRIMNM. On April 24, a CRCP-funded Coral Reef Ecosystem Division (CRED) monitoring cruise aboard the NOAA Ship *Hi`ialakai* returned to Honolulu from its last cruise leg—conducting Reef Assessment and Monitoring Program (RAMP) surveys in the Pacific Remote Islands Marine National Monument (PRIMNM). Biennial RAMP cruises have monitored conditions in this region since 2000.

Formal data analysis will begin shortly and will further clarify these early reports, but preliminary outcomes include observations of dominant coral species and overall hard coral cover on each island and comparisons of various populations with previous RAMP surveys. For instance, on Jarvis island, hard coral dominated the reefscape and shark populations appear to have returned to normal since the 2008 cruise, but macroinvertebrate counts were lower than normal. Low-level coral bleaching was observed at Palmyra Atoll and macroinvertebrates were nearly absent from survey results. Kingman Reef had a dramatic increase in cyanobacteria near a shipwreck but continues to harbor the highest concentration of giant clams observed in any of the Pacific regions surveyed by CRED.

Monitoring of coral reef ecosystems in the islands and banks of the PRIMNM—which are some of the last near-pristine, unpopulated coral reefs in the world—provides a baseline metric for ecosystem function. These remote areas are almost ideal laboratories to study the effects of global threats on coral reef ecosystems, such as climate change and ocean acidification, because they lack the numerous local anthropogenic impacts found in coral ecosystems closer to human populations.

Mariana Mission Provides Maps and Fisheries Information. During a 30-day cruise around Guam and the Commonwealth of the Northern Mariana Islands (CNMI), the NOAA Ship *Oscar Elton Sette* completed mapping and deployed four different types of instruments to monitor fish abundance and composition around six banks and islands. A video overview is available here. Three popular fishing banks south of Guam, Galvez Bank, a small bank to the south of Galvez, and 11-Mile Reef, were completely mapped using a pole-mounted multibeam sonar provided by the NOAA Coral Reef Ecosystem Division (CRED). Following mapping, two types of baited camera stations—CRED's BotCam and Baited Remote Underwater Video Stations (BRUVS) from the University of Guam and University of Western Australia—a towed camera system, and a SeaBed autonomous underwater vehicle (AUV) were tested to compare non-extractive methods for fish observations. During this cruise, AUV capabilities were enhanced by adding the capability to transmit data to the surface during deployment.

Operations then moved to Rota, CNMI, where the ship mapped in 40-300 m depths to add to previous multibeam coverage; additional BRUVS and AUV operations were also completed. After a mid-cruise stop in Saipan, mapping of Farallon de Medinilla was completed and revealed the previously unknown extent of this large underwater feature that is of interest to CNMI fisheries management agencies. During the final segment of the cruise, BRUVs and towed camera operations were conducted on the extensive banks west of Saipan. BRUVS data from 123 deployments at Galvez Bank, Rota, and West Saipan will be used by researchers from the University of Guam and University of Western Australia to compare fish populations and habitats in these three areas. Towed camera operations west of Saipan confirmed the existence of a rare and protected coral, *Euphyllia paraancora*, in that area. Education and outreach activities were conducted in Saipan and Guam and a NOAA Teacher at Sea participated in the cruise.

The Pacific Islands Fisheries Science Center, in response to requests from management agencies in Guam and CNMI made during the 2008 Pacific Coral Reef CREIOS workshop, initiated a series of four fisheries cruises in the western Pacific in 2010. Data from these cruises enhance the valuable on-going data set from biennial CRCP Reef Assessment and Monitoring Program (RAMP) cruises. Fisheries-related issues have been identified as one of the three major threats to coral reef ecosystems. Creating maps of important fisheries banks and islands and collection of fisheries data using non-extractive methods aids jurisdictional managers in making important fisheries decisions.

INTERNATIONAL UPDATES

MPA Capacity Building and Mesoamerican Reef Connectivity Workshop. An international workshop was held from May 17-19 in Chetumal, Mexico at the El Colegio de la Frontera Sur (ECOSUR) campus. This workshop promoted a better understanding of the bio-physical connectivity along the Mesoamerican Reef (MAR) and its potential role in ecosystem-scale management of associated protected areas. An exchange of experiences and ideas between management and scientific personnel at the workshop will be used to identify long-term common goals of the participating organizations. Resource managers, scientists, and other stakeholders from Belize, Guatemala, Honduras, Mexico and the US were invited to participate in this regional workshop; many of the invitees work with/in prioritized marine protected areas in the MAR.

Goals of the workshop included enhancing regional capacity by creating a MAR Connectivity Coalition of managers and scientists; providing a mechanism for on-going communications/ collaborations between participants, setting ecosystem-scale connectivity research priorities and identifying the priority regional connectivity goals; and identifying data sources that can be shared. A summary report will be provided to participants after the conclusion of the workshop.

CRW Participates in Australian Research Expedition. As a part of continuing collaborations between NOAA's Coral Reef Watch (CRW) and the Australian Institute of Marine Science (AIMS) in the southern Great Barrier Reef, NOAA staff participated in a research expedition in March 2010. The field study deployed oceanic drifters in the vicinity of Heron Island to monitor currents. Drifters were fitted with GPS trackers that communicate position via satellite SMS approximately every 10 minutes. The fieldwork was greatly hindered by a series of inclement weather conditions; however, subsequent to the expedition, the deployment of drifters was continued in late April 2010. This work is part of the ongoing collaboration between NOAA, AIMS and other Australian partners to study links between climate change and coral health, and is part of the Great Barrier Reef Ocean Observing System within the Australian Integrated Marine Observing System.

CRW Hosts International Workshop on Reef Remote Sensing. NOAA Coral Reef Watch, in collaboration with the University of Queensland Centre for Marine Studies, hosted an international workshop entitled "Satellite monitoring of coral reef vulnerability in a changing climage." Held in the Lamington National Park near Brisbane, Australia, from February 15-18, the workshop reviewed current satellite and ground-based coral reef environmental monitoring capabilities. It also reviewed the current coral reef management and science needs, from the perspective of environmental satellite data. Via a series of invited talks and group discussions, the workshop then investigated possible solutions to meet the identified needs, such as development of tools to monitor water quality, reef use, oil slicks, and others.

Thirty-four participants from the US, Mexico, and Australia attended. The participants, most of whom are world leaders in their respective fields, included a mixture of coral reef managers and scientists from relevant fields such as satellite remote sensing,

coral physiology, coral reef monitoring, oceanography, computer learning and informatics, and database management.

The workshop noted the importance of CRW's suite of satellite products to the management and science of coral bleaching. CRW's continued partnerships with Australian scientists and government agencies in coral reef research and protection have already leveraged Australian funds to help promote these collaborations that will ultimately help make our domestic activities more efficient. This workshop will help NOAA develop coral reef remote sensing products and use international expertise to improve our understanding and management of coral reef resources.

DIVE DEEPER: DEEP-SEA CORALS

Recent emphasis on the conservation of deep-sea corals and the associated new legislation have elevated awareness to the presence of these unique deep-ocean habitats. Deep-sea corals have been the focus of dozens of large-scale expeditions, but comparatively little attention has been given to deep-sea sponge fauna.

The first dedicated collections of deep-water (> 50 m) sponges from the central Aleutian Islands revealed a rich fauna including 28 novel species and geographical range extensions for 53 others. Based on these collections and the published literature we now confirm the presence of 121 species (or subspecies) of deep-water sponges in the Aleutian Islands. Clearly the deep-water sponge fauna of the Aleutian Islands is extraordinarily rich and largely understudied. Submersible observations revealed that sponges, rather than deep-sea corals, are the dominant feature shaping benthic habitats in the region and that they provide important refuge habitat for many species of fish and invertebrates including juvenile rockfish and king crabs. Examination of video footage collected along 127 km of the seafloor further indicate that there are likely hundreds of species, still uncollected from the region, that are unknown to science. Furthermore, sponges are extremely fragile and high rates of fishery bycatch clearly indicate a strong interaction between existing fisheries and sponge habitat.

Bycatch in fisheries and fisheries independent surveys can be a major source of information on the location of the sponge fauna but current monitoring programs are greatly hampered by the inability of deck personnel to identify bycatch. Help is on the way. A Guide to the Deep-water Sponges of the Aleutian Island Archipelago by Robert Stone, Helmut Lehnert, and Henry Reiswig is scheduled for publication sometime this summer. The main purpose of the guide is to provide fisheries observers and scientists with the information necessary to adequately identify sponge fauna so that areas of high abundance can be mapped and the locations of indicator species of vulnerable marine ecosystems can be determined. The guide is also designed for use by scientists making observations of the fauna *in situ* with submersibles including remotely operated vehicles and autonomous underwater vehicles.

The guide will be published as a NOAA Professional Paper and contains detailed species descriptions with photographs for more than 110 sponges found in Alaskan waters. NOAA's Deep Sea Coral Research and Technology Program is providing funding for publication of the guide.

NEW DATA IN CoRIS

Product Name	Description
C-CAP Land Cover Data, Hawaii	This data set consists of land cover derived from high resolution imagery and was analyzed according to the Coastal Change Analysis Program (C-CAP) protocol to determine land cover. These datasets utilized Quickbird multispectral scenes. All scenes were processed to detect C-CAP land cover features.
Sample Link: http://coris.noaa.gov/metadata/records/html/ccap_2006_lanai_land_cover.html	
C-CAP Land Cover Data, American Samoa	This data set consists of land cover derived from high resolution imagery and was analyzed according to the Coastal Change Analysis Program (C-CAP) protocol to determine land cover. These datasets utilized IKONOS and Quickbird multispectral scenes. All scenes were processed to detect C-CAP land cover features.
Sample Link: http://coris.noaa.gov/metadata/records/html/amer_samoa_swains_2002_ccap_hr_land_cover.html	
Synoptic Bi-monthly and Storm Response Water Quality Sampling in	Synoptic sampling including water column profiles and collected surface water samples was conducted on a bi-monthly basis throughout the rainy season (October-May) and on a monthly basis in the dry season

Southern Kaneohe Bay, HI November 2007 - April 2009 (NODC Accession 0062644)	(June-September) at nine locations in southern Kaneohe Bay in support of the Coral Reef Instrumented Monitoring Platform (CRIMP) program. Another dozen or so ancillary stations were also monitored selectively. This is the second set of data provided to NODC. The first set encompasses 2005 - October 2007 and is stored in NODC Accession 0060061.
Sample Link: http://coris.noaa.gov/metadata/records/html/nodc_fgdc_metadata_0060061.html	
US Environmental Protection Agency National Coastal Assessment for American Samoa 2004: water quality, sediment grain, and chemistry data (NODC Accession 0000455)	The survey sampled 49 stations on the islands of Tutuila, Aunu'u Ofu, Olosega, Ta'u during April and August, 2004. The water quality measurements data set contains two types of data: hydrologic profile water quality information resulting from in-field observations of physical data and water quality information resulting from laboratory examination of water quality samples for nutrient analyses. The sediment chemistry data set reports the contaminant name and its associated measured concentration, date site was visited, and the group that collected the data. The sediment grain size data set contains sediment grain analyses information resulting from laboratory examination of samples collected at sites visited during probability surveys.
Sample Link: http://coris.noaa.gov/metadata/records/html/nodc_fgdcmetadata_0000455.html	
Benthic Habitat Mapping off St. John, U.S. Virgin Islands National Park and Virgin Islands Reef National Monument project.	Benthic habitats of the shallow-water and moderate-depth marine environment in and around the Virgin Islands Coral Reef National Monument were mapped using a combination of semi-automated classification and visual interpretation of remotely sensed imagery and acoustic imagery. The objective of this effort, conducted by NOAA's Center for Coastal Monitoring and Assessment - Biogeography Branch in partnership with the U.S. National Park Service (NPS), was to provide spatially-explicit information on the habitat types, biological cover and live coral cover of the shallow-water and moderate-depth area south of St. John.
Sample Link: http://coris.noaa.gov/metadata/records/html/metadata_stjohn_moderatedepth_benthic_habitats.html	
2005 Oahu/Maui LiDAR Mapping Project	LiDAR data are remotely sensed high-resolution elevation data collected by an airborne collection platform. These data were collected over a portion of Maui and Oahu, Hawaii with a Leica ALS-40 Aerial Lidar Sensor. Multiple returns were recorded for each pulse in addition to an intensity value.
Sample Link: http://coris.noaa.gov/metadata/records/html/hi2005_template.html	
2003 Oahu Coastline LiDAR Mapping Project	LiDAR data are remotely sensed high-resolution elevation data collected by an airborne collection platform. These data were collected over a 100 meter swath of the Oahu, Hawaii coastline with a Leica ALS-40 Aerial Lidar Sensor. Multiple returns were recorded for each pulse in addition to an intensity value.
Sample Link: http://coris.noaa.gov/metadata/records/html/hi2005_template.html	
CRED Towed-Diver Benthic Characterization Surveys	Towboard surveys are a good method for obtaining a general description of large reef areas, assessing the status of low-density populations of large-bodied reef fish, large-scale disturbances (e.g., bleaching), general distribution and abundance patterns of macro-invertebrates (e.g., COT, giant clams), and for assessing trends in these populations and metrics. The benthic diver records percent cover of coral and macroalgae, estimates benthic habitat type and complexity,

	and censuses a suite of benthic macroinvertebrates including Crown of Thorns sea stars and sea urchins. The benthic towboard is equipped with a downward-facing digital still camera which images the benthos at 15 second intervals. These images are analyzed for percent cover of coral, algae, and other benthic components.
Sample Link: http://coris.noaa.gov/metadata/records/txt/cred_towboard_benthic_rose_atoll_2006.txt	
CRED Towed-Diver Fish Biomass Surveys	Towboard surveys are a good method for obtaining a general description of large reef areas, assessing the status of low-density populations of large-bodied reef fish, large-scale disturbances (e.g., bleaching), general distribution and abundance patterns of macro-invertebrates (e.g., COT, giant clams), and for assessing trends in these populations and metrics. The fish diver records, to the lowest possible taxon, all large-bodied reef fishes (>50cmTL) seen within 5m either side and 10m in front of the towboard. Length of each individual is estimated to the nearest cm. The fish towboard is also outfitted with a forward-facing digital video camera to record the survey swath.
Sample Link: http://coris.noaa.gov/metadata/records/txt/cred_towboard_fishbiomass_asuncion_island_2009.txt	
Impervious Surfaces, Island of Saipan, Commonwealth of the Northern Mariana Islands	This is a final impervious surface layer ready for distribution through NOAA CSC. The data set is an inventory of impervious surfaces for Saipan, Commonwealth of the Northern Mariana Islands for the year 2005. Impervious surfaces include manmade features such as building rooftops, parking lots and roads consisting of asphalt, concrete and/or compacted dirt. This data set utilized Quickbird multispectral scenes which were processed to detect impervious features on the Commonwealth of the Northern Mariana Islands.
Sample Link: http://coris.noaa.gov/metadata/records/txt/cnmi_saipan_2005_ccap_hr_impervious.txt	
C-CAP Land Cover, Jobos Bay, Commonwealth of Puerto Rico 2007	This data set consists of land cover derived from high resolution imagery and was analyzed according to the Coastal Change Analysis Program (C-CAP) protocol to determine land cover. This data set utilized 31 ADS40 digital orthophotos. The imagery was flown between November 2006 and March 2007. There are no cloud obscured areas within the base imagery. The scene was processed to detect C-CAP land cover features within the Jobos Bay watershed located on the southeastern coast of the Commonwealth of Puerto Rico.
Sample Link: http://coris.noaa.gov/metadata/records/txt/pr_jobosbay_2007_ccap_hr_land_cover.txt	

PUBLICATIONS

US Reef Jurisdictions Articulate Priority Reef Management Goals and Objectives. In May, the CRCP released seven strategic planning documents. These seven documents respectively articulate a set of strategic coral reef management priorities developed in consensus by the coral reef managers in each of the seven US coral reef jurisdictions. The CRCP provided support to the jurisdictions to coordinate with the broader management community in each place to determine strategic goals and objectives. NOAA will use these documents in conjunction with its *2010–2015 Coral Reef Conservation Program National Goals and Objectives* to direct its investment in each jurisdiction through grants, cooperative agreements and internal funding. NOAA will also make the document available to other potential funders, such as non-governmental organizations and federal partners, and encourage leveraging and new or expanded partnerships to achieve common coral reef conservation goals.

This priority setting process stems from an external review of the CRCP conducted in 2007 to independently assess how effectively the program has met its goals. The review included recommendations for future improvements. In response to the review, the CRCP developed a *Roadmap for the Future*, laying out new principles and priorities. A key part of this Roadmap includes facilitating the development of management priorities for each of the US state and territorial coral reef jurisdictions and

conducting capacity assessments to help achieve these priorities.

The next step in the process is to complete a capacity needs assessment in each jurisdiction. These assessments will help identify where gaps may exist in a jurisdiction's ability to achieve its management priorities. Outcomes from the capacity assessments will also be used to inform future funding decisions. A capacity assessment will be conducted for one jurisdiction by the end of fiscal year (FY) 2010. The remaining assessments will be conducted in FY2011.

CRCP Delivers Report on 2007-2009 Activities. On April 12, 2010, the CRCP delivered the *Implementation of the National Coral Reef Action Strategy: Report on NOAA Coral Reef Conservation Program Activities from 2007 to 2009* to Congress. It is the third of the biennial progress reports to Congress required by the Coral Reef Conservation Act of 2000. The report provides summaries and examples of the activities conducted by the CRCP and its extramural partners between 2007 and 2009 to implement the thirteen goals addressed in the *National Coral Reef Action Strategy*. The report also describes the Program's reorganization to focus its efforts to understand and address the three major threats to reefs; impacts from climate change, fishing, and land-based sources of pollution. During the period covered by this report, the CRCP operated pursuant to thirteen program goals organized under two themes: Understanding Coral Reef Ecosystems and Reducing the Adverse Impacts of Human Activities. The report presents activities undertaken for each of these goals, including mapping, assessment, monitoring, partnerships, socioeconomic research, and restoration, among others. It also includes summaries of some major reports produced by, or in partnership with, the CRCP during this time period as well as the outcomes of an external review and subsequent shifting of focus for the Program.

NOAA Delivers Deep-sea Coral Report to Congress. On March 3, NOAA delivered to key members of Congress a report on the *Implementation of the Deep Sea Coral Research and Technology Program 2008-2009*. The report, prepared in consultation with the Regional Fishery Management Councils, summarizes activities initiated with fiscal year 2009 Deep Sea Coral Research and Technology Program funding. It also presents a brief synopsis of additional conservation actions that have taken place since the first Report to Congress was submitted in 2008.

Proceedings from Second International Workshop on Red Coral Science Released. The family Coralliidae, consisting of the genera *Corallium* and *Paracorallium* and commonly known as pink and red corals, contains the most valuable and rarest taxa of precious corals in commerce. Seven species in this family have been intensively fished for use in jewelry, amulets, art objects, and homeopathic medicines. In March, NOAA released a new technical memorandum, *Proceedings of the International Workshop on Red Coral Science, Management, and Trade: Lessons from the Mediterranean*. Hosted by the Italian Ministry of Agriculture and Ministry of Environment and the CRCP in September of 2009, the second international red coral workshop provided an opportunity to discuss the best available science on the natural history of Mediterranean red coral (*Corallium rubrum* L.) and how it is managed throughout the region and utilized around the world. Attendees included scientists, managers, representatives of the coral fishery and manufacturing industries, policy makers, and environmental organizations from Europe, Africa, Asia, and North America.

Bare AY, Grimshaw KL, Rooney RR, Sabater MG, Fenner D, Carroll B (2010) Mesophotic communities of the insular shelf at Tutuila, American Samoa. *Coral Reefs* 29 (March 8). doi:10.1007/s00338-010-0600-y.

Kenyon JC, Wilkinson CB, Aeby GS (2010) Community structure of hermatypic corals at Midway Atoll in the Northwestern Hawaiian Islands: a legacy of human disturbance. *Atoll Research Bulletin* 581: 1-26.

Locker SD, Armstrong RA, Battista TA, Rooney JJ, Sherman C, Zawada DG (2010) Geomorphology of mesophotic coral ecosystems: current perspectives on morphology, distribution, and mapping strategies. *Coral Reefs* 29 (March 30). doi:10.1007/s00338-010-0613-6.

Rooney J, Donham E, Montgomery A, Spalding H, Parrish F, Boland R, Fenner D, Gove J, and Vetter O (2010) Mesophotic coral ecosystems in the Hawaiian Archipelago. *Coral Reefs* 29 (February 27). doi:10.1007/s00338-010-0596-3.

Vroom, PS and Braun, CL. 2010. Benthic Composition of a Healthy Subtropical Reef: Baseline Species-Level Cover, with an Emphasis on Algae, in the Northwestern Hawaiian Islands. published on-line in *PLoS One*, March 2010, Vol. 5, Issue 3, e9733.

March-May I...dendum.doc

Lauren_Chhay.vcf (0.3 KB)

501 W. Ocean Blvd.
Long Beach, CA 90802
John.Cubit@noaa.gov
tel 562 980-4081; fax 562 980-4084

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John Cubit, Ph.D.
Regional Resource Coordinator, Southwest Region
NOAA Assessment and Restoration Division, Suite 4470
501 W. Ocean Blvd.
Long Beach, CA 90802
John.Cubit@noaa.gov
tel 562 980-4081; fax 562 980-4084
Cell phone (for urgent matters and travel contact) 562 810-4949

Begin forwarded message:

From: Carys Mitchelmore [redacted] B6 Privacy @umces.edu>
Date: May 20, 2010 12:30:19 AM EDT
To: coral-list@coral.aoml.noaa.gov
Subject: **Re: [Coral-List] Corexit 9500 and corals**
Reply-To: mitchelmore@cbl.umces.edu

Hi,

I havn't been following very many of the threads lately. But I see some people are asking about dispersant toxicity to corals. I would be happy to provide my 2 pennies worth on dispersants to corals generally (I co-wrote the NRC dispersant effect book in 2005 and wrote the section on corals!).

In addition I carried out a 2 year study (yet to be published although the interim reports are available from the funding agency; CRRC UNH) specifically on Corexit 9500 on the soft coral Xenia. Bottom line is at levels that may be environmentally relevant they were acutely toxic, they stopped pulsing (nearly instantly), they lost algae, ulcerated (not sure in which order) and with time (or higher doses) simply dissolved. Short-time low dose exposures showed delayed effects and much reduced growth after one month in recovery. Dispersed oil was worse (affected by the dissolved and droplet phases).

I'd be happy to help with any questions. I would also like to ask about the hydrous oxide stated to be in the dispersant? How did you find this information?

Best wishes,
Carys

--
Carys Mitchelmore
Associate Professor
University of Maryland Center for Environmental Science
Chesapeake Biological Laboratory
PO Box 38
(1 Williams Street)
Solomons
MD 20688
USA

____

Begin forwarded message:

From: Douglas Fenner [redacted]
Date: May 20, 2010 4:26:40 AM EDT
To: coral-list@coral.aoml.noaa.gov
Subject: **Re: [Coral-List] A plea to stay on topic**

I was thinking we should get back on topic too.

Anybody care to speculate whether dispersant and dispersed oil may get caught in the loop current along with the floating oil (becoming tar balls) and be on it's way to Florida, and if it gets there will it whiz by the Keys and reefs without stopping or will it be so diluted that it can't affect corals? (I sure don't know)

On the other hand, the messages reporting bleaching in Thailand and the Maldives are exactly why the question of how to reduce CO2 emissions is so important for the future of coral reefs. If we don't get it under control, we can kiss reefs as we know them goodby in 20-30 years or less (and say hello to algae beds). As someone said, 'We are the first generation to see the beauty of living coral reefs with our own eyes, it would be a tragedy if we also were the last.'

Doug

----- Original Message -----
From: "Lescinsky, Halard L" [redacted]>
To: <coral-list@coral.aoml.noaa.gov>
Sent: Wednesday, May 19, 2010 8:54 AM
Subject: [Coral-List] A plea to stay on topic

> Can we please use the moderator's authority to keep the discussion on topic.. Energy futures, global warming and much of what has been coming across lately really is pretty far removed from coral reefs. I'd love to keep my inbox a little smaller.--- Hal Lescinsky
>
> ____
>

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Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 20, 2010 9:08:22 AM EDT
To: Cheryl Woodley <Cheryl.Woodley@noaa.gov>
Subject: **Re: Court test of biomarkers?**

Cheryl,
Thanks for putting this together. They are having another call today at 2:30EST that hopefully you can be on. I unfortunately got pulled away from the call the other day only to find out that I will be coordinating and managing the overall restoration planning team for this incident for the next 3-6 months. I am going to still try to be on the calls but will not be as much of the driving force

Hollings Marine Laboratory
331 Fort Johnson Rd
Charleston, SC 29412
843.762.8862 Phone
843.762.8737 Fax
cheryl.woodley@noaa.gov

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

--
Cheryl Woodley, Ph.D.
Coral Health and Disease Program

DOC/NOAA/NOS/NCCOS
Center for Coastal Environmental Health and Biomolecular Research
Hollings Marine Laboratory
331 Fort Johnson Rd
Charleston, SC 29412
843.762.8862 Phone
843.762.8737 Fax
cheryl.woodley@noaa.gov

Begin forwarded message:

From: vassil zlatarski <[redacted]@yahoo.com>
Date: May 20, 2010 9:32:17 AM EDT
To: Coral-List <coral-list@coral.aoml.noaa.gov>
Subject: Re: [Coral-List] Corexit 9500 and corals

Dear Coral-Listers,

The effect of the oil dispersant Corexit is ominously hinted by its name (coral+exit).

Do we have the necessary information about the effect of all used dispersants to human body, especially to divers, working in waters treated with oil dispersants?

Cheers,

Vassil
131 Fales Rd., Bristol, RI 02809, USA; tel.: +1-[redacted]

--- On Thu, 5/20/10, Carys Mitchelmore <mitchelm@umces.edu> wrote:

From: Carys Mitchelmore <mitchelm@umces.edu>

Subject: Re: [Coral-List] Corexit 9500 and corals
To: coral-list@coral.aoml.noaa.gov
Date: Thursday, May 20, 2010, 12:30 AM

Hi,

I havn't been following very many of the threads lately. But I see some people are asking about dispersant toxicity to corals. I would be happy to provide my 2 pennies worth on dispersants to corals generally (I co-wrote the NRC dispersant effect book in 2005 and wrote the section on corals!).

In addition I carried out a 2 year study (yet to be published although the interim reports are available from the funding agency; CRRC UNH) specifically on Corexit 9500 on the soft coral Xenia. Bottom line is at levels that may be environmentally relevant they were acutely toxic, they stopped pulsing (nearly instantly), they lost algae, ulcerated (not sure in which order) and with time (or higher doses) simply dissolved. Short-time low dose exposures showed delayed effects and much reduced growth after one month in recovery. Dispersed oil was worse (affected by the dissolved and droplet phases).

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Best wishes,
Carys

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Carys Mitchelmore
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PO Box 38
(1 Williams Street)
Solomons
MD 20688
USA

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http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

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http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

Begin forwarded message:

From: Bill Allison [redacted] @gmail.com>
Date: May 20, 2010 9:51:04 AM EDT
To: coral-list@coral.aoml.noaa.gov
Cc: mitchelmore@cbl.umces.edu
Subject: **Re: [Coral-List] Corexit 9500 and corals**

Insofar as accurate assessment of the magnitude and nature of oil masses adrift in the Gulf have consequences for coral reef systems this, abstracted from todays NY Times (link at end) seems relevant:

Rick Steiner, a marine biologist and a veteran of the 1989 Exxon

Valdez<http://topics.nytimes.com/top/reference/timestopics/subjects/e/exxon_valdez_oil_spill_1989/index.html?inline=nyt-classifier>disaster,
.... said the likelihood of extensive undersea plumes of oil
droplets should have been anticipated from the moment the spill began, given
that such an effect from deepwater blowouts had been predicted in the
scientific literature for more than a decade, and confirmed in a test off
the coast of Norway. An extensive sampling program to map and characterize
those plumes should have been put in place from the first days of the spill,
he said.

Ian MacDonald of Florida State
University<http://topics.nytimes.com/top/reference/timestopics/organizations/f/florida_state_university/index.html?inline=nyt-org>,
an oceanographer who was among the first to question the official estimate
of 210,000 gallons a day, said he had come to the conclusion that the oil
company was bent on obstructing any accurate calculation. “They want to hide
the body,” he said.

Scientists have long theorized that a shallow spill and a spill in the deep
ocean — this one is a mile down — would behave quite differently. A 2003
report by the National Research
Council<http://graphics8.nytimes.com/packages/pdf/national/excerptfrom2003report.pdf>predicted
that the oil in a deepwater blowout could break into fine
droplets, forming plumes of oil mixed with water that would not quickly rise
to the surface.

That prediction appeared to be confirmed Saturday when the researchers
aboard the Pelican reported that they had detected immense plumes that they
believed were made of oil particles. The results were not final, and came as
a surprise to the government. They raise a major concern, that sea life in
concentrated areas could be exposed to a heavy load of toxic materials as
the plumes drift through the sea.

http://www.nytimes.com/2010/05/20/science/earth/20noaa.html?hp

Also check this weeks Nature for two articles on the topic.

Regards,
Bill

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"reality leaves a lot to the imagination..." John Lennon

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Coral-List mailing list
Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinfo/coral-list
Begin forwarded message:

From: DWHNRDA <dwhnrda@gmail.com>
Date: May 20, 2010 11:56:10 AM EDT
To: ademopoulos@usgs.gov, astratto@clam.mi.nmfs.gov, Bill.Goodwin@noaa.gov, Bill.Precht@noaa.gov, Brian.T.Pawlak@noaa.gov, Chantal.Collier@dep.state.fl.us, charles.jabaly@dep.state.fl.us, colleen_charles@usgs.gov, Dan.Dorfman@noaa.gov, dondea@miamidade.gov, Emma.Hickerson@noaa.gov, Fan.Tsao@noaa.gov, Felipe.Arzayus@noaa.gov, gbrewer@usgs.gov, George.Schmahl@noaa.gov, Greg.Piniak@noaa.gov, gregory_boland@mms.gov, janice.duquesnel@dep.state.fl.us, Jeff.Hyland@noaa.gov, Jennifer.Koss@noaa.gov, Jennifer.Moore@noaa.gov, joanna.walczak@dep.state.fl.us, Joe.Schittone@noaa.gov, John.Cubit@noaa.gov, John.Embesi@noaa.gov, John.Hunt@myfwc.com, John.Mcdonough@noaa.gov, Kacky.Andrews@noaa.gov, karen_battle-sanborn@nps.gov, ksulak@usgs.gov, Lauri.Maclaughlin@noaa.gov, lcarver@wlf.la.gov, Margaret.W.Miller@noaa.gov, MaryElliott.Rolle@noaa.gov, patricia.cortelyou-hamilton@sol.doi.gov, Peter.Etnoyer@noaa.gov, rob.ruzicka@myfwc.com, Shay.Viehman@noaa.gov, Steve.Gittings@noaa.gov, Tom.Hourigan@noaa.gov, Tom.Moore@noaa.gov, Vladimir.Kosmynin@dep.state.fl.us, Cheryl Woodley <Cheryl.Woodley@noaa.gov>, Ilsa Kuffner <ikuffner@usgs.gov>, Stephen Blair <BlairS@miamidade.gov>
Subject: **Attn: DWH Coral Group**

Coral Group:

See message below, forwarded from John Cubit.

_____

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> Carys
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> --
> Carys Mitchelmore
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Coral-List mailing list
Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

Begin forwarded message:

From: "John.Cubit" <John.Cubit@noaa.gov>
Date: May 20, 2010 1:37:05 PM EDT
To: DWHNRDA <dwhnrda@gmail.com>
Cc: ademopoulos@usgs.gov, astratto@clam.mi.nmfs.gov, Bill.Goodwin@noaa.gov, Bill.Precht@noaa.gov, Brian.T.Pawlak@noaa.gov, Chantal.Collier@dep.state.fl.us, charles.jabaly@dep.state.fl.us, colleen_charles@usgs.gov, Dan.Dorfman@noaa.gov, dondea@miamidade.gov, Emma.Hickerson@noaa.gov, Fan.Tsao@noaa.gov, Felipe.Arzayus@noaa.gov, gbrewer@usgs.gov, George.Schmahl@noaa.gov, Greg.Piniak@noaa.gov, gregory_boland@mms.gov, janice.duquesnel@dep.state.fl.us, Jeff.Hyland@noaa.gov, Jennifer.Koss@noaa.gov, Jennifer.Moore@noaa.gov, joanna.walczak@dep.state.fl.us, Joe.Schittone@noaa.gov, John.Embesi@noaa.gov, John.Hunt@myfwc.com, John.Mcdonough@noaa.gov, Kacky.Andrews@noaa.gov, karen_battle-sanborn@nps.gov, ksulak@usgs.gov, Lauri.Maclaughlin@noaa.gov, lcarver@wlf.la.gov, Margaret.W.Miller@noaa.gov, MaryElliott.Rolle@noaa.gov, patricia.cortelyou-hamilton@sol.doi.gov, Peter.Etnoyer@noaa.gov, rob.ruzicka@myfwc.com, Shay.Viehman@noaa.gov, Steve.Gittings@noaa.gov, Tom.Hourigan@noaa.gov, Tom.Moore@noaa.gov, Vladimir.Kosmynin@dep.state.fl.us, Cheryl Woodley <Cheryl.Woodley@noaa.gov>, Ilsa Kuffner <ikuffner@usgs.gov>, Stephen Blair <BlairS@miamidade.gov>
Subject: **Re: Attn: DWH Coral Group**
Reply-To: John.Cubit@noaa.gov

All,
Unfortunately DWHNRDA did not include the header to the message. It is from the Coral-List server, not me.
It is an FYI in case you are not subscribed to Coral-List.
John

DWHNRDA wrote:

Coral Group:

See message below, forwarded from John Cubit.

_____

Insofar as accurate assessment of the magnitude and nature of oil masses adrift in the Gulf have consequences for coral reef systems this, abstracted from todays NY Times (link at end) seems relevant:

Rick Steiner, a marine biologist and a veteran of the 1989 Exxon Valdez<http://topics.nytimes.com/top/reference/timestopics/subjects/e/exxon_valdez_oil_spill_1989/index.html?inline=nyt-classifier>disaster,
.... said the likelihood of extensive undersea plumes of oil droplets should have been anticipated from the moment the spill began, given that such an effect from deepwater blowouts had been predicted in the scientific literature for more than a decade, and confirmed in a test off the coast of Norway. An extensive sampling program to map and characterize those plumes should have been put in place from the first days of the spill, he said.

Ian MacDonald of Florida State University<http://topics.nytimes.com/top/reference/timestopics/organizations/f/florida_state_university/index.html?inline=nyt-org>, an oceanographer who was among the first to question the official estimate of 210,000 gallons a day, said he had come to the conclusion that the oil company was bent on obstructing any accurate calculation. “They want to hide the body,” he said.

Scientists have long theorized that a shallow spill and a spill in the deep ocean — this one is a mile down — would behave quite differently. A 2003 report by the National Research Council<http://graphics8.nytimes.com/packages/pdf/national/excerptfrom2003report.pdf>predicted that the oil in a deepwater blowout could break into fine droplets, forming plumes of oil mixed with water that would not quickly rise to the surface.

That prediction appeared to be confirmed Saturday when the researchers aboard the Pelican reported that they had detected immense plumes that they believed were made of oil particles. The results were not final, and came as a surprise to the government. They raise a major concern, that sea life in concentrated areas could be exposed to a heavy load of toxic materials as the plumes drift through the sea.

http://www.nytimes.com/2010/05/20/science/earth/20noaa.html?hp

Also check this weeks Nature for two articles on the topic.

Regards,
Bill

On Thu, May 20, 2010 at 12:30 AM, Carys Mitchelmore <mitchelm@umces.edu>wrote:

> Hi,
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> I havn't been following very many of the threads lately. But I see
> some people are asking about dispersant toxicity to corals. I would be
> happy to provide my 2 pennies worth on dispersants to corals generally
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> toxic, they stopped pulsing (nearly instantly), they lost algae,
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> and much reduced growth after one month in recovery. Dispersed oil was
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> Best wishes,
> Carys
>
> --
> Carys Mitchelmore
> Associate Professor
> University of Maryland Center for Environmental Science
> Chesapeake Biological Laboratory
> PO Box 38
> (1 Williams Street)
> Solomons
> MD 20688
> USA
>
> ____

>

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____
"reality leaves a lot to the imagination..." John Lennon
____

--
John Cubit, Ph.D.
Regional Resource Coordinator, Southwest Region
NOAA Assessment and Restoration Division, Suite 4470
501 W. Ocean Blvd.
Long Beach, CA 90802
John.Cubit@noaa.gov
tel 562 980-4081; fax 562 980-4084
Cell phone (for urgent matters and travel contact) 562 810-4949

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 20, 2010 2:56:31 PM EDT
To: Cheryl Woodley <Cheryl.Woodley@noaa.gov>, Mike Buchman <Mike.Buchman@noaa.gov>
Subject: **Fwd: Attn: DWH Coral Group**

Begin forwarded message:

From: "John.Cubit" <John.Cubit@noaa.gov>

Date: May 20, 2010 1:37:05 PM EDT
To: DWHNRDA <dwhnrda@gmail.com>
Cc: ademopoulos@usgs.gov, astratto@clam.mi.nmfs.gov, Bill.Goodwin@noaa.gov, Bill.Precht@noaa.gov, Brian.T.Pawlak@noaa.gov, Chantal.Collier@dep.state.fl.us, charles.jabaly@dep.state.fl.us, colleen_charles@usgs.gov, Dan.Dorfman@noaa.gov, dondea@miamidade.gov, Emma.Hickerson@noaa.gov, Fan.Tsao@noaa.gov, Felipe.Arzayus@noaa.gov, gbrewer@usgs.gov, George.Schmahl@noaa.gov, Greg.Piniak@noaa.gov, gregory_boland@mms.gov, janice.duquesnel@dep.state.fl.us, Jeff.Hyland@noaa.gov, Jennifer.Koss@noaa.gov, Jennifer.Moore@noaa.gov, joanna.walczak@dep.state.fl.us, Joe.Schittone@noaa.gov, John.Embesi@noaa.gov, John.Hunt@myfwc.com, John.Mcdonough@noaa.gov, Kacky.Andrews@noaa.gov, karen_battle-sanborn@nps.gov, ksulak@usgs.gov, Lauri.Maclaughlin@noaa.gov, lcarver@wlf.la.gov, Margaret.W.Miller@noaa.gov, MaryElliott.Rolle@noaa.gov, patricia.cortelyou-hamilton@sol.doi.gov, Peter.Etnoyer@noaa.gov, rob.ruzicka@myfwc.com, Shay.Viehman@noaa.gov, Steve.Gittings@noaa.gov, Tom.Hourigan@noaa.gov, Tom.Moore@noaa.gov, Vladimir.Kosmynin@dep.state.fl.us, Cheryl Woodley <Cheryl.Woodley@noaa.gov>, Ilsa Kuffner <ikuffner@usgs.gov>, Stephen Blair <BlairS@miamidade.gov>
Subject: Re: Attn: DWH Coral Group
Reply-To: John.Cubit@noaa.gov

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> Coral-List mailing list
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John Cubit, Ph.D.
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Cell phone (for urgent matters and travel contact) 562 810-4949

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

Begin forwarded message:

From: Ed Blume <[redacted]@gmail.com>
Date: May 20, 2010 1:47:04 PM EDT
To: vassil zlatarski <[redacted]yahoo.com>
Cc: Coral-List <coral-list@coral.aoml.noaa.gov>
Subject: **Re: [Coral-List] Corexit 9500 and corals**

From a scientific point of view, which is harder on coral -- spilled oil or Corexit? If Corexit is worse, wouldn't it be appropriate for someone(s) in the scientific community to say so? Wouldn't it bring science to bear on a public concern?

Ed Blume
Madison, WI
www.renewwisconsin.org

On Thu, May 20, 2010 at 8:32 AM, vassil zlatarski <vzlatarski@yahoo.com>wrote:

Dear Coral-Listers,

The effect of the oil dispersant Corexit is ominously hinted by its name (coral+exit).

Do we have the necessary information about the effect of all used dispersants to human body, especially to divers, working in waters treated with oil dispersants?

Cheers,

Vassil
131 Fales Rd., Bristol, RI 02809, USA; tel.: +1-[redacted]

--- On Thu, 5/20/10, Carys Mitchelmore <mitchelm@umces.edu> wrote:

From: Carys Mitchelmore <mitchelm@umces.edu>
Subject: Re: [Coral-List] Corexit 9500 and corals
To: coral-list@coral.aoml.noaa.gov
Date: Thursday, May 20, 2010, 12:30 AM

Hi,

I havn't been following very many of the threads lately. But I see some people are asking about dispersant toxicity to corals. I would be happy to provide my 2 pennies worth on dispersants to corals generally (I co-wrote the NRC dispersant effect book in 2005 and wrote the section on corals!).

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Best wishes,
Carys

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Carys Mitchelmore
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Solomons
MD 20688
USA

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http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

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Begin forwarded message:

From: David Evans <B6 Privacy [redacted]@yahoo.com>
Date: May 20, 2010 2:44:29 PM EDT
To: coral-list@coral.aoml.noaa.gov
Subject: **Re: [Coral-List] Corexit 9500 and corals (Carys Mitchelmore)**

Any idea how the hard-bottom communities are fairing on the offshore platform legs in the region of the leak off Louisiana, Mississippi, and Alabama? ... The ones that are likely being bathed currently in the surface slick of oil and dispersant... Would that knowledge have any application to understanding the effect of this oil-dispersant mixture on the more tropical reef communities or maybe not...? Maybe those rigs out there don't have the same communities that they do further west off Texas...

Just a thought...

Best,
David J. Evans

<<<Knock at the door: 'Have you heard the good news!' ....
SD: 'Yeah! ... There's Cookies!!!' ...

-It's all a matter of perspective->>>

by anonymous

____
From: "coral-list-request@coral.aoml.noaa.gov" <coral-list-request@coral.aoml.noaa.gov>
To: coral-list@coral.aoml.noaa.gov
Sent: Thu, May 20, 2010 10:07:14 AM
Subject: Coral-List Digest, Vol 21, Issue 27

Message: 6
Date: Thu, 20 May 2010 00:30:19 -0400
From: "Carys Mitchelmore" <mitchelm@umces.edu>
Subject: Re: [Coral-List] Corexit 9500 and corals
To: coral-list@coral.aoml.noaa.gov
Message-ID: <20100520003019.13022e9ddn4jfo48@www.cbl.umces.edu>
Content-Type: text/plain; charset=ISO-8859-1; DelSp="Yes";
format="flowed"

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End of Coral-List Digest, Vol 21, Issue 27
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http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

Begin forwarded message:

From: Rob Ricker <Rob.Ricker@noaa.gov>
Date: May 20, 2010 5:27:58 PM EDT
To: Greg Baker <Greg.Baker@noaa.gov>
Cc: Scott Stout <sstout@newfields.com>, Chris Reddy <creddy@whoi.edu>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Deborah French McCay <dfrench@appsci.com>, James Payne <jrpayne@sbcglobal.net>, Tom Moore <Tom.Moore@noaa.gov>, Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: URGENT: fielding teams for upcoming cruises

Greg,

I just got off a call with various individuals throughout NMFS and NOS and the University of South Florida (and others from various academic institutions) for planning sampling on a couple of upcoming cruises. In short, there are two vessels preparing to go back to sea, and we can put NRDA teams on each vessel to collect samples and data for NRDA. I believe that the *Weatherbird* is supposed to head back out this weekend, and NOAA's *Gordon Gunter* (a 68 m long vessel) is scheduled to head to sea next Tuesday. There is also the *Jack Fitz*, which I understand is scheduled to depart for another NRDA cruise tomorrow.

I would like you, Greg, to schedule a call with all of us listed on this email as soon as possible so that we can discuss the following:

1) Establish a dedicated team for collecting the source oil, dispersant, and various stages of weathered oil, oil+dispersant, and water and tarball samples. I've spoken with both Chris Reddy and Scott Stout to identify who we could assign to do this sampling. Scott is short on staff, but Chris has three of his lab members who are up to date with 8hr HAZWOPPER, some who could be deployed as early as tomorrow. We need to decide who will go on each vessel. I'd like Greg to compile the names of folks who will go into the field and make sure that Troy and Ian are are of the operation plans for staffing and activity.

2) Identify the types of samples and data that we'd like to collect on these cruises. Scott is working up a list of the samples he needs for the environmental forensics, and many of these types of samples are the same as previously identified by Jim and

Debbie for the modeling input. Debbie is organizing personnel and equipment for analyzing droplet size, which might involve a person to use microscopy techniques of use a coulter counter. We need to determine what equipment and the number of individuals who we'd like to get on the vessels. I understand that Dan and Tom may also have needs for getting folks out to sea for collecting more plankton data... again -- I need to know your requirements today.

3) The Gordon Gunter is likely to get access to the hot zone and the Weatherbird is likely to work farther afield. We don't know how close we'll be able to get to the well head because of all the response activity, but we can discuss this on the call.

Please try to make yourselves available as soon as possible. Thanks Greg for your help setting up this call. I have to be on a call in 10 minutes with EPA re. coordination of their on-water efforts with ours. I'll jump off the EPA call if needed -- just call my cell or send me an email, which I'll be monitoring.

Rob

P.S. Laurie, I know that you are shifting over to

--
Rob Ricker, Ph.D.
Regional Manager, SW Region
Assessment & Restoration Division
Office of Response and Restoration, NOAA
777 Sonoma Ave, Suite 219A
Santa Rosa, CA 95404
C [redacted]
F [redacted]
E rob.ricker@noaa.gov

Begin forwarded message:

From: Nasseer Idrisi [redacted]@uvi.edu>
Date: May 20, 2010 4:35:19 PM EDT
To: Steve Mussman <[redacted]@earthlink.net>, "coral-list@coral.aoml.noaa.gov" <coral-list@coral.aoml.noaa.gov>
Subject: **Re: [Coral-List] A Plea To Stay On Topic**

All,
I have to agree with Steve Mussman. How is discussion of the BP blowout 'not on topic' with regards to coral and coral reef research and interest? It seems (my own opinion) that this disaster may cause damaging effects throughout the Gulf of Mexico, Caribbean, and other regions of the Atlantic before all is done. Just as ocean acidification (caused by oil after its burnt) is an important topic to coral research, crude oil (before its burnt) and dispersant mixtures should be of concern. Coupled to higher than average SST in the tropical Atlantic, the BP blowout may lead to an environmental loss greater than was seen in 2005 in the Caribbean. These stressors should be collectively discussed and debated.
nasseer

On 5/20/10 3:54 PM, "Steve Mussman" <[redacted]@earthlink.net> wrote:

> Hi Julian,
 Your perspective is well supported. The fact that there seems
> to be
a spontaneous increase in the number of postings related to energy
> policy,
climate change and the BP oil blowout should be viewed as a
> progressive
development, not something worthy of constraint. I would ask how
> these
issues could not be conceived as directly relating to coral reef

science?
Are scientists so narrowly focused on their specific research fields
that
they fail to see the bigger picture?
If the dynamics of the current
disaster doesn't energize listers to
reexamine our overall energy mix along
with the related issue of climate change,
nothing will. More and more people
are urging scientists to take advantage of
their high standing among public
figures to advocate for much needed change..
We certainly can not leave it to
political figures who are highly influenced
by institutionalized special
interests to lead the way.
We may not be able to instantaneously shift the
course to our energy future,
but we have to move to change the current
trajectory before it is too late.
Just yesterday, the National Academy of
Sciences issued it's strongest warning
to date, stating that the "U.S. should
act now to reduce greenhouse gas emissions
and develop a national strategy to
adapt to the inevitable impacts of climate change."
(http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=05192010)

If we don't act soon, coral reef scientists may leave behind only a legacy of
missed opportunities.

And to Glenn "MC" Diver, this is not a "Save the
Reefs" statement.
No one is preventing you from remaining free to form your
own
opinions.

Regards,
Steve

____
Cor
al-List mailing
list
Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinf
o/coral-list

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Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

Begin forwarded message:

From: Magnus Johnson <[redacted]>
Date: May 20, 2010 4:35:46 PM EDT
To: "coral-list@coral.aoml.noaa.gov" <coral-list@coral.aoml.noaa.gov>
Subject: **[Coral-List] ***SPAM*** Re: A Plea To Stay On Topic**

I've only just joined this list but I was hoping to learn something about
the biology and ecology of tropical marine systems, for which there are few

fora that get beyond "coffee table book" or (often naive) environmentalist
discussions. I do not deny that these things are important but there are
many many places where these things are discussed and I nowadays find myself
filtering them out in order to get at more interesting nerdy-science posts.

How different dispersants affect coral, bleaching records in various parts
of the world, impacts of climate change on reef systems are interesting and
valid topics. Energy policy is interesting but, to me should be discussed
elsewhere.

In order to solve problems in the environment there is a need for more
information on the nitty gritty physiological and ecological details
relating to reefs. Most ecologists/marine biologists are not narrowly
focussed and are concerned about the world around them but there is room in
the tool box for arenas where we can discuss/contemplate/learn about
important details in isolation. I hoped this was one of them.

Cheers, Magnus

--
Dr Magnus Johnson
Centre for Environmental and Marine Sciences
University of Hull

http://tiny.cc/b4y7j

____
Coral-List mailing list
Coral-List@coral.aoml.noaa.gov
http://coral.aoml.noaa.gov/mailman/listinfo/coral-list

Begin forwarded message:

From: Andrew Negri [redacted]>
Date: May 20, 2010 5:56:25 PM EDT
To: "coral-list@coral.aoml.noaa.gov" <coral-list@coral.aoml.noaa.gov>
Subject: [Coral-List] Corexit 9527

Good morning from the Great Barrier Reef,

Here Corexit 9527 was recently used to disperse a slick resulting from the grounding of the coal carrier Shen Neng 1 on a coral shoal.
We also published a paper on the effects of Corexit 9527 - in this case the effects on coral fertilization and larval settlement in Acropora.

Negri AP, Heyward AJ (2000) Inhibition of fertilization and larval metamorphosis of the coral Acropora millepora (Ehrenberg, 1834) by petroleum products. Marine Pollution Bulletin 41:420-427

Cheers,

Andrew
<>< <>< <>< <>< <>< <>< <>< <>< <>< <><
Andrew Negri
Senior Research Scientist
Australian Institute of Marine Science
PMB No. 3 Townsville MC QLD 4810 Australia

a.negri@aims.gov.au<mailto:a.negri@aims.gov.au>
Negri CV<http://data.aims.gov.au/staffcv/jsf/external/view.jspx?partyId=100000139> Publication list<http://data.aims.gov.au/extpubs/do/extsearch.do?author=negri&initials=a>
Phone: (07) 4753 4322
Fax: (07) 4772 5852
Mob: B6 Privacy
<>< <>< <>< <>< <>< <>< <>< <>< <>< <><

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Begin forwarded message:

From: Tom Moore <tom.moore@noaa.gov>
Date: May 20, 2010 6:20:28 PM EDT
To: Rob Ricker <Rob.Ricker@noaa.gov>
Cc: Greg Baker <Greg.Baker@noaa.gov>, Scott Stout <sstout@newfields.com>, Chris Reddy <creddy@whoi.edu>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Deborah French McCay <dfrench@appsci.com>, James Payne <jrpayne@sbcglobal.net>, Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: Re: URGENT: fielding teams for upcoming cruises

We had been looking to redeploy SIPPER on the next round of the Jack Fitz but could make the Gordon Gunter deployment if we make a decsion today/tomorrow.   If we went off the Gordon Gunter we would only need one berth because ships crew could provide the other needed support. Also all SIPPER deployments could be done at night if that would help limit impact on other operations.

Sent from my wireless...

On May 20, 2010, at 5:27 PM, Rob Ricker <Rob.Ricker@noaa.gov> wrote:

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P.S. Laurie, I know that you are shifting over to

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Rob Ricker, Ph.D.
Regional Manager, SW Region
Assessment & Restoration Division
Office of Response and Restoration, NOAA
777 Sonoma Ave, Suite 219A
Santa Rosa, CA 95404
C [redacted]
F [redacted]
E rob.ricker@noaa.gov

Begin forwarded message:

From: Tom Moore <tom.moore@noaa.gov>
Date: May 20, 2010 6:28:19 PM EDT
To: Rob Ricker <Rob.Ricker@noaa.gov>
Cc: Greg Baker <Greg.Baker@noaa.gov>, Scott Stout <sstout@newfields.com>, Chris Reddy <creddy@whoi.edu>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Deborah French McCay <dfrench@appsci.com>, James Payne <jrpayne@sbcglobal.net>, Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: **Re: URGENT: fielding teams for upcoming cruises**

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Sent from my wireless...

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Rob Ricker, Ph.D.
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Office of Response and Restoration, NOAA
777 Sonoma Ave, Suite 219A
Santa Rosa, CA 95404
C [redacted]
F [redacted]
E rob.ricker@noaa.gov

Begin forwarded message:

From: Rob Ricker <Rob.Ricker@noaa.gov>
Date: May 20, 2010 6:31:27 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Cc: Greg Baker <Greg.Baker@noaa.gov>, Scott Stout <sstout@newfields.com>, Chris Reddy <creddy@whoi.edu>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Deborah French McCay <dfrench@appsci.com>, James Payne <jrpayne@sbcglobal.net>, Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: Re: URGENT: fielding teams for upcoming cruises

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Santa Rosa, CA 95404
C [redacted]
F [redacted]
E rob.ricker@noaa.gov

Begin forwarded message:

From: Tom Moore <tom.moore@noaa.gov>

Date: May 20, 2010 6:35:53 PM EDT
To: Rob Ricker <Rob.Ricker@noaa.gov>
Cc: Greg Baker <Greg.Baker@noaa.gov>, Scott Stout <sstout@newfields.com>, Chris Reddy <creddy@whoi.edu>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Deborah French McCay <dfrench@appsci.com>, James Payne <jrpayne@sbcglobal.net>, Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
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C [redacted]
F [redacted]
E rob.ricker@noaa.gov

Begin forwarded message:

From: Greg Baker <Greg.Baker@noaa.gov>
Date: May 20, 2010 6:40:11 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Cc: Rob Ricker <Rob.Ricker@noaa.gov>, Scott Stout <sstout@newfields.com>, Chris Reddy <creddy@whoi.edu>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Deborah French McCay <dfrench@appsci.com>, James Payne <jrpayne@sbcglobal.net>, Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: Re: URGENT: fielding teams for upcoming cruises CALL AT 4PM Pacific, 7PM Eastern (20 minutes)

For all who can, please jump on the following conf line to discuss at 4PM Pacific:

[redacted] passcode [redacted]

Greg Baker

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777 Sonoma Ave, Suite 219A
Santa Rosa, CA 95404
C B6 Privacy
F B6 Privacy
E rob.ricker@noaa.gov <mailto:rob.ricker@noaa.gov>

Begin forwarded message:

From: Rob Ricker <Rob.Ricker@noaa.gov>
Date: May 20, 2010 6:40:51 PM EDT
To: Tom Moore <Tom.Moore@noaa.gov>
Cc: Greg Baker <Greg.Baker@noaa.gov>, Scott Stout <sstout@newfields.com>, Chris Reddy <creddy@whoi.edu>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Deborah French McCay <dfrench@appsci.com>, James Payne <jrpayne@sbcglobal.net>, Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: Re: URGENT: fielding teams for upcoming cruises

I raised the access issue as one of the main priorities for us on the Gordon Gunter. Because we have support for this cruise at the highest NOAA levels, I know that this request is going through to the Response operations as a high priority.

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C [redacted]
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Date: May 20, 2010 6:51:53 PM EDT
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Subject: Re: URGENT: fielding teams for upcoming cruises

Cool -- we'll go with that as one part of our request. You don't need to be on the call that GB is setting up if that is all you will be requesting, but you are welcome to join.

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C [redacted]
F [redacted]
E rob.ricker@noaa.gov

Begin forwarded message:

From: creddy@whoi.edu
Date: May 20, 2010 8:15:33 PM EDT
To: Rob Ricker <Rob.Ricker@noaa.gov>

Cc: Tom Moore <Tom.Moore@noaa.gov>, Greg Baker <Greg.Baker@noaa.gov>, Scott Stout <sstout@newfields.com>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Laurie Sullivan <Laurie.Sullivan@noaa.gov>, Deborah French McCay <dfrench@appsci.com>, James Payne <jrpayne@sbcglobal.net>, Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: Technicians available from Woods Hole

Hi All

Three people, all who have taken the 8 hr course, are available from Cape Cod and willing to fly asap.

Catherine Carmichael--good organic geochemistry skills, organized...limited sea time and little knowledge of sampling at sea. Would be a solid assistant.

Bob Nelson and Sean Sylva---solid organic geochemistry technicians, both have been at sea for at least a year total, with a little training could handle sampling operations on any platform.

yours,
Chris Reddy

Quoting Rob Ricker <Rob.Ricker@noaa.gov>:

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upcoming cruises. In short, there are two vessels preparing to go back to sea, and we can put NRDA teams on each vessel to collect samples and data for NRDA. I believe that the Weatherbird is supposed to head back out this weekend, and NOAA's Gordon Gunter (a 68 m long vessel) is scheduled to head to sea next Tuesday. There is also the Jack Fitz, which I understand is scheduled to depart for another NRDA cruise tomorrow.

I would like you, Greg, to schedule a call with all of us listed on this email as soon as possible so that we can discuss the following:

1) Establish a dedicated team for collecting the source oil, dispersant, and various stages of weathered oil, oil+dispersant, and water and tarball samples. I've spoken with both Chris Reddy and Scott Stout to identify who we could assign to do this sampling. Scott is short on staff, but Chris has three of his lab members who are up to date with 8hr HAZWOPPER, some who could be deployed as early as tomorrow. We need to decide who will go on each vessel. I'd like Greg to compile the names of folks who will go into the field and make sure that Troy and Ian are are of the operation plans for staffing and activity.

2) Identify the types of samples and data that we'd like to collect on these cruises. Scott is working up a list of the samples he needs for the environmental forensics, and many of these types of samples are the same as previously identified by Jim and Debbie for the modeling input. Debbie is organizing personnel and equipment for analyzing droplet size, which might involve a person to use microscopy techniques of use a coulter counter. We need to determine what equipment and the number of individuals who we'd like to get on the vessels. I understand that Dan and Tom may also have needs for getting folks out to sea for collecting more plankton data... again -- I need to know your requirements today.

3) The Gordon Gunter is likely to get access to the hot zone and the Weatherbird is likely to work farther afield. We don't know how close we'll be able to get to the well head because of all the response activity, but we can discuss this on the call.

Please try to make yourselves available as soon as possible. Thanks Greg for your help setting up this call. I have to be on a call in 10 minutes with EPA re. coordination of their on-water efforts with ours. I'll jump off the EPA call if needed -- just call my cell or send me an email, which I'll be monitoring.

Rob

P.S. Laurie, I know that you are shifting over to

--
Rob Ricker, Ph.D.
Regional Manager, SW Region
Assessment & Restoration Division
Office of Response and Restoration, NOAA
777 Sonoma Ave, Suite 219A
Santa Rosa, CA 95404
C B6 Privacy
F B6 Privacy
E rob.ricker@noaa.gov

--
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777 Sonoma Ave, Suite 219A
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C [redacted]
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777 Sonoma Ave, Suite 219A
Santa Rosa, CA 95404
C [redacted]
F [redacted]
E rob.ricker@noaa.gov

This message was sent using IMP, the Internet Messaging Program.

Begin forwarded message:

From: Laurie Sullivan <Laurie.Sullivan@noaa.gov>
Date: May 20, 2010 8:41:22 PM EDT
To: creddy@whoi.edu
Cc: Rob Ricker <Rob.Ricker@noaa.gov>, Tom Moore <Tom.Moore@noaa.gov>, Greg Baker <Greg.Baker@noaa.gov>, Scott Stout <sstout@newfields.com>, Daniel Hahn <Daniel.Hahn@noaa.gov>, Deborah French McCay <dfrench@appsci.com>, James Payne <jrpayne@sbcglobal.net>, Christopher Plaisted <Christopher.Plaisted@noaa.gov>, Stephanie Willis <Stephanie.Willis@noaa.gov>
Subject: Re: Technicians available from Woods Hole

This should have the safety requirements for this incident. You need to sign the NOAA safety plan. I think the directions are in the NOAA Safety Documentation Requirements attachemnt

creddy@whoi.edu wrote:

Hi All

Three people, all who have taken the 8 hr course, are available from Cape Cod and willing to fly asap.

Catherine Carmichael--good organic geochemistry skills, organized...limited sea time and little knowledge of sampling at sea. Would be a solid assistant.

Bob Nelson and Sean Sylva---solid organic geochemistry technicians, both have been at sea for at least a year total, with a little training could handle sampling operations on any platform.

yours,
Chris Reddy

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Office of Response and Restoration, NOAA

LSU Sea Grant Building, Room 124B
Baton Rouge, LA 70803
(cell) [redacted]
(office) [redacted]
(fax) [redacted]

Begin forwarded message:

From: Cheryl Brodnax <Cheryl.Brodnax@noaa.gov>
Date: May 21, 2010 11:22:22 AM EDT
To: "'tom.moore@noaa.gov'" <Tom.Moore@noaa.gov>, "'leslie.craig@noaa.gov'" <Leslie.Craig@noaa.gov>, "'jean.cowan@noaa.gov'" <Jean.Cowan@noaa.gov>
Subject: Fw: Long term fate and transport (incl. fractionating) of subsurface oil from GoM Deepwater Horizon leak

Interesting chain

From: Robert Jacobsen <rjacobsen@taylorengineering.com>
To: Schexnayder, Mark A. <MSchexnayder@agcenter.lsu.edu>
Cc: Jerome Zeringue <Jerome.Zeringue@LA.GOV>; richard.raynie@la.gov <richard.raynie@la.gov>; james.pahl@la.gov <james.pahl@la.gov>; griffith.bryon@epa.gov <griffith.bryon@epa.gov>; Todd Davison <Todd.Davison@noaa.gov>; Tim.Osborn@noaa.gov <Tim.Osborn@noaa.gov>; Coreil, Paul D. <PCoreil@agcenter.lsu.edu>; Chuck Wilson <cwilson@lsu.edu>; Thomas, Glenn <GThomas@agcenter.lsu.edu>; Cheryl Brodnax <cheryl.brodnax@noaa.gov>; Robert Twilley <rtwilley@lsu.edu>; Mullen, Stephen R. <SMullen@agcenter.lsu.edu>; Wolcott, Maurice C. <MWolcott@agcenter.lsu.edu>; Leonard Bahr <leonardbahr@gmail.com>; johnlopez@pobox.com <johnlopez@pobox.com>; Steve Mathies <Steve.Mathies@LA.GOV>; Natalie Snider <nsnider@crcl.org>; Natalie Snider <nsnider@crcl.org>; stevenp@crcl.org <stevenp@crcl.org>; hscons@lsu.edu <hscons@lsu.edu>; thibod@lsu.edu <thibod@lsu.edu>; Paul Kemp <pkemp@audubon.org>
Sent: Fri May 21 11:14:06 2010
Subject: Long term fate and transport (incl. fractionating) of subsurface oil from GoM Deepwater Horizon leak

Mark:
The discussion you forwarded me (below) on plume fractionation is an interesting attempt at a very important analysis.

Developing a reasonable notion of the volume of oil, it's potential re-distribution in the water column, and it's transport and fate--is JOB 1 for the ecosystem response community. This is TEXTBOOK environmental protection--taught in undergraduate environmental classes for two decades and undestood by any professional. "The man" on fate and transport is Dr. Louis Thibodeaux at the LSU Department of Chemical Engineering. He authored the classic "Environmental Chemodynamics" and has taught the course for decades. On April 30th, one day after BP increased the leak estimate rate from 1,000 to 5,000 BBL/day the Wall Street Journal reported that some scientists were indicating the rate could be much higher. We have lost much valuable time in addressing this issue.

Consider this: If BP stopped the leak tomorrow it is still likely that we will have millions of BBLS of oil in the subsurface GoM. At an average concentration of 1% (oil in water), each 1 million BBLs of "dispersed" plume is the equivalent of a toxic oil soup 20 square miles 1 foot deep. In actuality, there will be multiple plumes, at varying specific gravities and depths, with varying concentrations and thicknesses, fractionating in the subsurface for MONTHS to come! If substantial plugging of the leak does not occur for many more weeks, it is likely that there will be tens of millions of BBLS of subsurface oil.

The ecosystem response community needs to get a handle on what we're dealing with ASAP and formulate reasonable "end points." We may well learn over this summer that we will have to aim for some modest level of Delta-Wide restoration 3-5 years (it may be 10 years) down the road.

Our most significant tool may well be MASSIVE DIVERSIONS of Mississippi River water into Breton Sound and Barataria/Terrebonne Bays next spring and for many springs to come.

Your idea about using the Bohemia Spillway will likely become critical!

Bob

From: Schexnayder, Mark A. [mailto:MSchexnayder@agcenter.lsu.edu]
Sent: Thursday, May 20, 2010 10:30 AM
To: Robert Jacobsen
Subject: Fwd: noladishu posts on oil complexity w/ chemical engineer info

Plume composition discussion

Mark Schexnayder
Coastal Advisor
LSU AgCenter/La. Sea Grant

Begin forwarded message:

From: "Picou, Stephen" <SPicou@agcenter.lsu.edu>
Date: May 20, 2010 10:07:25 AM CDT
To: "Schexnayder, Mark A." <MSchexnayder@agcenter.lsu.edu>
Subject: noladishu posts on oil complexity w/ chemical engineer info

More scary but informative information about exactly what this stuff is and could be.

SP

From: [redacted]@gmail.com" [redacted]@yahoo.com>
Date: Wed, 19 May 2010 18:14:59
To: NOLA Bloggers<nola-bloggers@googlegroups.com>
Subject: [Bloggers] Re: Fwd: Fwd: Oil on your beach? Help us document it

That's complicated. Chemical composition can change over time. Wells can heavy-up and sour-up. Also, there's a ChemE at The Oil Drum that's suggested that, in a nut shell, the oil is becoming fractionated as it leaves the leak. Between hydrostatic pressure gradients, Corexit treatment, and multiple grades of oil, there may actually be three chemically distinct plumes of oil leaving the wellhead all flowing in different, 3-dimensional ways.

It's possible that chemical analysis of the surface oil is leading them to discount the heavier fractions coming from the same well. OTOH, the article references "bilge water" as a possible source. Bilges contain refined oil (lube oil, etc.) that is chemically quite unique compared to raw crude. For example, Lube Oil doesn't flouresce (sp?) under UV light. If you dig around on these guys website (http://www.oilinwatermonitors.com/), you can learn a little more. They make the overboard analyzers that the Coast Guard, et. al. requires to be on every offshore platform's produced water leg.

In the end, this could be the same oil from a heavier fraction, or it could be from a different source, possibly refined oil from a ship's lube oil system.

Here's the post from The Oil Drum:

I think I can explain the fractionation of the oil from the Deepwater Horizon spill. This is different from an ordinary blow-out in that the methane remains supercritical all the way up the drill hole to the blow-out preventer (BOP) the way the well is discharging now. Since the hydrocarbon reservoir that was penetrated has a high methane content, and is at very high pressure (~15000 psi), I am pretty sure that within the reservoir the oil + gas are miscible; a "supercritical solution." There is not a separate oil layer & gas layer until pressure is reduced. My hypothesis can explain three subsurface oil plumes:

1. A preliminary phase separation occurs between the heaviest oil components (asphaltenes) and the rest of the crude oil, which remains in a methane-based supercritical solution, as the crude rises the 18000 feet from the reservoir to the bottom of the BOP. Gravitational pressure drop depends on average density of the solution, which I guess to be ~.6 g/cc; a pressure reduction on the order of 6000 psi

can be anticipated, and a corresponding temperature reduction and volume increase corresponding to adiabatic expansion. The heaviest fraction is hypothesized to have already phase separated from the crude oil prior to reaching the BOP, and this phase forms the deepest oil plume, floating within 40 feet of the sea floor. (In rising from the reservoir, most of the pressure drop is due to gravitational lifting, as the flow is too slow for much viscous dissipation. The flow may be fast enough to sweep the phase separated asphaltenes up the pipe, if the velocity is greater than the sedimentation velocity of the asphaltene droplets.)

2. A very large pressure drop occurs in passing through the partially sealed BOP. When the solution goes through the flow restriction at the BOP, its pressure goes from ~9000 psi to near 2250 psi, causing a phase separation in which the natural gas based phase goes subcritical in less than a second. Even after the expansion, the two phase flow is still very hot, high enough for the methane phase to remain a good solvent for the light oil fractions. (The expansion should be close to an isothermal expansion, differing only from isothermal due to the Joule effect, and due to condensation of a liquid phase; I expect a small increase in temperature going through the BOP orifice.) As pressure and density are reduced, the supercritical methane phase decomposes into two phases, a primarily heavy oil liquid phase, saturated with methane (I expect this to be a viscous liquid, specific gravity ~.8; still containing quite a bit of dissolved methane), and:

3. A subcritical dense gas phase solution containing most of the gasoline and light oil fractions, and some heavy oil. This dense gas phase also forms downstream of the BOP “orifice.” This dense gas phase contains most of the methane. After this exits the pipe and mixes with sea water, the methane separates out as this solution cools, leading to the lowest density, lowest viscosity, fastest rising oil plume. This fraction, the light oil/gasoline plume could have a density as low as ~.75 g/cc) and would rise quickly; perhaps this is the only plume to reach the surface so far.

4. A fourth subsea plume of methane hydrate is formed as the natural gas separates from the light oil/gas phase as it cools and expands (after exiting the riser pipe). Most of the methane forms hydrates and slowly settles to the ocean floor (methane hydrate at this depth has density of 1.04 g/cc, so it sinks).
This scenario can explain four distinct plumes emanating from the leaking Deep Horizon well head. Most of the 3-phase hydrocarbon mixture vents out of the riser about a mile away from the BOP, while something like 15% of the hydrocarbon flow exits from a kink just above the BOP. After the three hydrocarbon phases mix with sea water, the fourth phase (methane hydrate) forms. The asphaltenes, which form the densest phase and the lowest plume, may take years to reach the surface, by which time they may well have mixed with the Atlantic deep waters via the circulation around Florida.

What is happening at the Deep Horizon oil spill is sort of a doomsday scenario, which can only happen this way because of the unique stepwise pressure reduction as the oil exits the reservoir. Because the oil has been fractionated, it is not rising as a single phase, as has been the case in all previous oil spills. If my hypothesis is correct, most of the oil is contained in two separate plumes that have not yet reached the ocean surface...God help us.

There are testable predictions that come out of this theory:

1) If there are three oil plumes as I suggest, and the oil that has

made it to the surface so far is from the "lightest" (lowest molecular
weight, lowest boiling point range). The tarballs that are forming now
will be the residue of the light fraction, after evaporation of
volatiles, and should be depleted of asphaltenes compared to the oil
samples obtained by BP before they attempted to kill the well.

2) Similarly, there should be asphaltene content differences between
each of the plume samples collected by the Pelican Research vessel
(http://news.olemiss.edu/index.php?/niustblog/) such that asphaltene
content is highest for the deepest samples.

> To post to this group, send email to nola-bloggers@googlegroups.com.
> To unsubscribe from this group, send email to nola-bloggers+unsubscribe@googlegroups.com.
> For more options, visit this group at http://groups.google.com/group/nola-bloggers?hl=en.

--
You received this message because you are subscribed to the Google Groups "NOLA Bloggers" group.
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To unsubscribe from this group, send email to nola-bloggers+unsubscribe@googlegroups.com.
For more options, visit this group at http://groups.google.com/group/nola-bloggers?hl=en.

"Noladishu@gmail.com" <NolaEngineer1984@yahoo.com> May 19 07:51PM -0700 ^

More ChemE nerdiness:

----
http://www.theoildrum.com/node/6482#comment-625925

WHY IS THE OIL RED?

Just getting back online; not up on latest posts. Yesterday Alan
verified that the submerged oil looks red. I just looked at the
Greenpeace photos posted today showing reddish light colored oil clots
(not really as firm as tarballs). I suspect these are reflective
(white tone) due to entrained sea water droplets in the oil (the same
reason that mayonnaise is white: both are "water in oil" emulsions, I
think). Would someone please check that for me? If I am correct, if
you heat these clots up, boil away the water, they should look like
red oil; "maltenes" is one term applicable. If as I predict, this fits
with my hypothesis posted in detail yesterday (http://
www.theoildrum.com/node/6481#comment-625641)that fractionation of the
oil is occurring on or below the seafloor. The reddish snotty stuff in
the Greenpeace photos is the middle cut, the portion that drops out of
solution as the supercritical solution goes subcritical as it goes
from ~9000 psi in front of the orifice (BOP leak) to about 2250 psi
just down stream of there. This oil is colored because it has very low
content of asphaltenes (which are very black), I think because the
asphaltenes phase separated from the supercritical mixture (methane/
ethane/.../oil/) as the crude oil rose 18000 feet from the reservoir
to the BOP.

I note the following news from NOAA yesterday:

>6. Samples of water from the underwater "plumes" have been taken by the Pelican research ship. These samples have been divided and sent to testing centers, but no results are yet available.

I predict that individual droplets will tend to fall in one of three categories, asphaltenes, maltenes, or light hydrocarbons. The plumes may contain particles of two different kinds, however; for example, large asphaltene droplets at 1.00 specific gravity could rise faster than emulsified small droplet size maltenes at specific gravity 0.85 (e.g.). I expect there are likely to be five apparent plumes, two of which are created by overlap areas of two plumes: going from the bottom to the top: asphaltene; asphaltene + maltene; maltene; maltene + light hydrocarbons; light hydrocarbons. I think these are the five plume layers detected by the Pelican.

[If samples sit around a while the light hyrocarbon phase may dissolve back into the maltene phase (a fairly slow process because this occurs via either brownian motion or else hexane-like molecules dissolving into water then dissolving into the maltene droplets).]

Each phase will be slightly contaminated with the other phase, but the composition of individual droplets will be distinctly one of the phases (unless two or more droplets have merged to form a given droplet), with light hydrocarbons fraction floating fastest, and asphaltenes rising slowest (if all droplets were the same size, but of course they are not).

I also predict that eventually the asphaltene layer will reach the surface. The high asphaltene content phase will be reminiscent of "stillbottoms" sort of material. It may well have a softening temperature high enough that it will almost be like sand when it reaches the surface. I do not believe this material (asphaltenes) will be nearly as dangerous to sea life as the oil; mainly because these are likely solids at sea water temperature (and if we are lucky, stay solid in hot sun on the beach). I don't think asphaltenes will wet out feathers or gills, whereas the emulsified oil might. Asphaltenes are widely distributed in nature. They are found in all sedimentary rocks, and occasionally deposits of pure asphaltenes are formed (e.g., Gilsonite).

Sincerely,

Steve Picou

Area Housing Agent

LSU AgCenter Crescent Region

504-838-1170 - office

[redacted] - cell

spicou@agcenter.lsu.edu

http://www.louisianahouse.org

http://www.lsuagcenter.com/rebuilding/

http://www.lsuagcenter.com/disasterrecovery/

"The economy is a wholly owned subsidiary of the environment,

not the other way around" - Gaylord Nelson

"Work with the earth, not against it. For the earth does not belong to you.
You belong to the earth." - Wallace Stegner

P Please consider the environment before printing this email.

Missing Plug-in

Begin forwarded message:

From: Tom Moore <Tom.Moore@noaa.gov>
Date: May 21, 2010 11:52:59 AM EDT
To: Debbie French McCay <DFrenchMcCay@asascience.com>
Subject: Fwd: Long term fate and transport (incl. fractionating) of subsurface oil from GoM Deepwater Horizon leak

FYI...

Begin forwarded message:

From: Cheryl Brodnax <Cheryl.Brodnax@noaa.gov>
Date: May 21, 2010 11:22:22 AM EDT
To: "'tom.moore@noaa.gov'" <Tom.Moore@noaa.gov>, "'leslie.craig@noaa.gov'" <Leslie.Craig@noaa.gov>, "'jean.cowan@noaa.gov'" <Jean.Cowan@noaa.gov>
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To: Schexnayder, Mark A. <MSchexnayder@agcenter.lsu.edu>
Cc: Jerome Zeringue <Jerome.Zeringue@LA.GOV>; richard.raynie@la.gov <richard.raynie@la.gov>; james.pahl@la.gov <james.pahl@la.gov>; griffith.bryon@epa.gov <griffith.bryon@epa.gov>; Todd Davison <Todd.Davison@noaa.gov>; Tim.Osborn@noaa.gov <Tim.Osborn@noaa.gov>; Coreil, Paul D. <PCoreil@agcenter.lsu.edu>; Chuck Wilson <cwilson@lsu.edu>; Thomas, Glenn <GThomas@agcenter.lsu.edu>; Cheryl Brodnax <cheryl.brodnax@noaa.gov>; Robert Twilley <rtwilley@lsu.edu>; Mullen, Stephen R. <SMullen@agcenter.lsu.edu>; Wolcott, Maurice C. <MWolcott@agcenter.lsu.edu>; Leonard Bahr <leonardbahr@gmail.com>; johnlopez@pobox.com <johnlopez@pobox.com>; Steve Mathies <Steve.Mathies@LA.GOV>; Natalie Snider <nsnider@crcl.org>; Natalie Snider <nsnider@crcl.org>; stevenp@crcl.org <stevenp@crcl.org>; hscons@lsu.edu <hscons@lsu.edu>; thibod@lsu.edu <thibod@lsu.edu>; Paul Kemp <pkemp@audubon.org>
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Consider this: If BP stopped the leak tomorrow it is still likely that we will have millions of BBLS of oil in the subsurface GoM. At an average concentration of 1% (oil in water), each 1 million BBLs of "dispersed" plume is the equivalent of a toxic oil soup 20 square miles 1 foot deep. In actuality, there will be multiple plumes, at varying specific gravities and depths, with varying concentrations and thicknesses, fractionating in the subsurface for MONTHS to come! If substantial plugging of the leak does not occur for many more weeks, it is likely that there will be tens of millions of BBLS of subsurface oil.

The ecosystem response community needs to get a handle on what we're dealing with ASAP and formulate reasonable "end points." We may well learn over this summer that we will have to aim for some modest level of Delta-Wide restoration 3-5 years (it may be 10 years) down the road.

Our most significant tool may well be MASSIVE DIVERSIONS of Mississippi River water into Breton Sound and Barataria/Terrebonne Bays next spring and for many springs to come.

Your idea about using the Bohemia Spillway will likely become critical!

Bob

From: Schexnayder, Mark A. [mailto:MSchexnayder@agcenter.lsu.edu]
Sent: Thursday, May 20, 2010 10:30 AM
To: Robert Jacobsen
Subject: Fwd: noladishu posts on oil complexity w/ chemical engineer info

Plume composition discussion

Mark Schexnayder
Coastal Advisor
LSU AgCenter/La. Sea Grant

Begin forwarded message:

> **From:** "Picou, Stephen" <SPicou@agcenter.lsu.edu>
> **Date:** May 20, 2010 10:07:25 AM CDT
> **To:** "Schexnayder, Mark A." <MSchexnayder@agcenter.lsu.edu>
> **Subject: noladishu posts on oil complexity w/ chemical engineer info**

More scary but informative information about exactly what this stuff is and could be.

SP

From: [redacted]
Date: Wed, 19 May 2010 18:14:59
To: NOLA Bloggers<nola-bloggers@googlegroups.com>
Subject: [Bloggers] Re: Fwd: Fwd: Oil on your beach? Help us document it

That's complicated. Chemical composition can change over time. Wells can heavy-up and sour-up. Also, there's a ChemE at The Oil Drum that's suggested that, in a nut shell, the oil is becoming fractionated as it leaves the leak. Between hydrostatic pressure gradients, Corexit treatment, and multiple grades of oil, there may actually be three chemically distinct plumes of oil leaving the wellhead all flowing in different, 3-dimensional ways.

It's possible that chemical analysis of the surface oil is leading them to discount the heavier fractions coming from the same well. OTOH, the article references "bilge water" as a possible source. Bilges contain refined oil (lube oil, etc.) that is chemically quite unique compared to raw crude. For example, Lube Oil doesn't flouresce (sp?) under UV light. If you dig around on these guys website (http://www.oilinwatermonitors.com/), you can learn a little more. They make the overboard analyzers that the Coast Guard, et. al. requires to be on every offshore platform's produced water leg.

In the end, this could be the same oil from a heavier fraction, or it could be from a different source, possibly refined oil from a ship's lube oil system.

Here's the post from The Oil Drum:

I think I can explain the fractionation of the oil from the Deepwater Horizon spill. This is different from an ordinary blow-out in that the methane remains supercritical all the way up the drill hole to the blow-out preventer (BOP) the way the well is discharging now. Since the hydrocarbon reservoir that was penetrated has a high methane content, and is at very high pressure (~15000 psi), I am pretty sure that within the reservoir the oil + gas are miscible; a "supercritical solution." There is not a separate oil layer & gas layer until pressure is reduced. My hypothesis can explain three subsurface oil plumes:

1. A preliminary phase separation occurs between the heaviest oil components (asphaltenes) and the rest of the crude oil, which remains in a methane-based supercritical solution, as the crude rises the 18000 feet from the reservoir to the bottom of the BOP. Gravitational pressure drop depends on average density of the solution, which I guess to be ~.6 g/cc; a pressure reduction on the order of 6000 psi can be anticipated, and a corresponding temperature reduction and volume increase corresponding to adiabatic expansion. The heaviest fraction is hypothesized to have already phase separated from the crude oil prior to reaching the BOP, and this phase forms the deepest oil plume, floating within 40 feet of the sea floor. (In rising from the reservoir, most of the pressure drop is due to gravitational lifting, as the flow is too slow for much viscous dissipation. The flow may be fast enough to sweep the phase separated asphaltenes up the pipe, if the velocity is greater than the sedimentation velocity of the asphaltene droplets.)

2. A very large pressure drop occurs in passing through the partially sealed BOP. When the solution goes through the flow restriction at the BOP, its pressure goes from ~9000 psi to near 2250 psi, causing a phase separation in which the natural gas based phase goes subcritical in less than a second. Even after the expansion, the two phase flow is still very hot, high enough for the methane phase to remain a good solvent for the light oil fractions. (The expansion should be close to an isothermal expansion, differing only from isothermal due to the Joule effect, and due to condensation of a liquid phase; I expect a small increase in temperature going through the BOP orifice.) As pressure and density are reduced, the supercritical methane phase decomposes into two phases, a primarily heavy oil liquid phase, saturated with methane (I expect this to be a viscous liquid, specific gravity ~.8; still containing quite a bit of dissolved methane), and:

3. A subcritical dense gas phase solution containing most of the gasoline and light oil fractions, and some heavy oil. This dense gas phase also forms downstream of the BOP “orifice.” This dense gas phase contains most of the methane. After this exits the pipe and mixes with sea water, the methane separates out as this solution cools, leading to the lowest density, lowest viscosity, fastest rising oil plume. This fraction, the light oil/gasoline plume could have a density as low as ~.75 g/cc) and would rise quickly; perhaps this is the only plume to reach the surface so far.

4. A fourth subsea plume of methane hydrate is formed as the natural gas separates from the light oil/gas phase as it cools and expands (after exiting the riser pipe). Most of the methane forms hydrates and slowly settles to the ocean floor (methane hydrate at this depth has density of 1.04 g/cc, so it sinks).
This scenario can explain four distinct plumes emanating from the

leaking Deep Horizon well head. Most of the 3-phase hydrocarbon mixture vents out of the riser about a mile away from the BOP, while something like 15% of the hydrocarbon flow exits from a kink just above the BOP. After the three hydrocarbon phases mix with sea water, the fourth phase (methane hydrate) forms. The asphaltenes, which form the densest phase and the lowest plume, may take years to reach the surface, by which time they may well have mixed with the Atlantic deep waters via the circulation around Florida.

What is happening at the Deep Horizon oil spill is sort of a doomsday scenario, which can only happen this way because of the unique stepwise pressure reduction as the oil exits the reservoir. Because the oil has been fractionated, it is not rising as a single phase, as has been the case in all previous oil spills. If my hypothesis is correct, most of the oil is contained in two separate plumes that have not yet reached the ocean surface...God help us.

There are testable predictions that come out of this theory:

1) If there are three oil plumes as I suggest, and the oil that has made it to the surface so far is from the "lightest" (lowest molecular weight, lowest boiling point range). The tarballs that are forming now will be the residue of the light fraction, after evaporation of volatiles, and should be depleted of asphaltenes compared to the oil samples obtained by BP before they attempted to kill the well.

2) Similarly, there should be asphaltene content differences between each of the plume samples collected by the Pelican Research vessel (http://news.olemiss.edu/index.php?/niustblog/) such that asphaltene content is highest for the deepest samples.

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You received this message because you are subscribed to the Google Groups "NOLA Bloggers" group.
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For more options, visit this group at http://groups.google.com/group/nola-bloggers?hl=en.

"Noladishu@gmail.com" <NolaEngineer1984@yahoo.com> May 19 07:51PM -0700 ^

More ChemE nerdiness:

----
http://www.theoildrum.com/node/6482#comment-625925

WHY IS THE OIL RED?

Just getting back online; not up on latest posts. Yesterday Alan verified that the submerged oil looks red. I just looked at the Greenpeace photos posted today showing reddish light colored oil clots

(not really as firm as tarballs). I suspect these are reflective (white tone) due to entrained sea water droplets in the oil (the same reason that mayonnaise is white: both are "water in oil" emulsions, I think). Would someone please check that for me? If I am correct, if you heat these clots up, boil away the water, they should look like red oil; "maltenes" is one term applicable. If as I predict, this fits with my hypothesis posted in detail yesterday (http://www.theoildrum.com/node/6481#comment-625641)that fractionation of the oil is occurring on or below the seafloor. The reddish snotty stuff in the Greenpeace photos is the middle cut, the portion that drops out of solution as the supercritical solution goes subcritical as it goes from ~9000 psi in front of the orifice (BOP leak) to about 2250 psi just down stream of there. This oil is colored because it has very low content of asphaltenes (which are very black), I think because the asphaltenes phase separated from the supercritical mixture (methane/ethane/.../oil/) as the crude oil rose 18000 feet from the reservoir to the BOP.

I note the following news from NOAA yesterday:

>6. Samples of water from the underwater "plumes" have been taken by the Pelican research ship. These samples have been divided and sent to testing centers, but no results are yet available.

I predict that individual droplets will tend to fall in one of three categories, asphaltenes, maltenes, or light hydrocarbons. The plumes may contain particles of two different kinds, however; for example, large asphaltene droplets at 1.00 specific gravity could rise faster than emulsified small droplet size maltenes at specific gravity 0.85 (e.g.). I expect there are likely to be five apparent plumes, two of which are created by overlap areas of two plumes: going from the bottom to the top: asphaltene; asphaltene + maltene; maltene; maltene + light hydrocarbons; light hydrocarbons. I think these are the five plume layers detected by the Pelican.

[If samples sit around a while the light hyrocarbon phase may dissolve back into the maltene phase (a fairly slow process because this occurs via either brownian motion or else hexane-like molecules dissolving into water then dissolving into the maltene droplets).]

Each phase will be slightly contaminated with the other phase, but the composition of individual droplets will be distinctly one of the phases (unless two or more droplets have merged to form a given droplet), with light hydrocarbons fraction floating fastest, and asphaltenes rising slowest (if all droplets were the same size, but of course they are not).

I also predict that eventually the asphaltene layer will reach the surface. The high asphaltene content phase will be reminiscent of "stillbottoms" sort of material. It may well have a softening temperature high enough that it will almost be like sand when it reaches the surface. I do not believe this material (asphaltenes) will be nearly as dangerous to sea life as the oil; mainly because these are likely solids at sea water temperature (and if we are lucky, stay solid in hot sun on the beach). I don't think asphaltenes will wet out feathers or gills, whereas the emulsified oil might. Asphaltenes are widely distributed in nature. They are found in all sedimentary rocks, and occasionally deposits of pure asphaltenes are formed (e.g., Gilsonite).

Sincerely,

Steve Picou

Area Housing Agent

LSU AgCenter Crescent Region

504-838-1170 - office

[redacted] - cell

spicou@agcenter.lsu.edu

http://www.louisianahouse.org

http://www.lsuagcenter.com/rebuilding/

http://www.lsuagcenter.com/disasterrecovery/

"The economy is a wholly owned subsidiary of the environment,
not the other way around" - Gaylord Nelson

"Work with the earth, not against it. For the earth does not belong to you.
You belong to the earth." - Wallace Stegner

P Please consider the environment before printing this email.

Missing Plug-in

Tom Moore
NOAA Restoration Center
263 13th Ave South
St. Petersburg, Florida 33701

727-551-5716 Office
[redacted] Cell

Begin forwarded message:

From: DWHNRDA <dwhnrda@gmail.com>
Date: May 24, 2010 3:11:11 PM EDT
To: ademopoulos@usgs.gov, astratto@clam.mi.nmfs.gov, Bill.Goodwin@noaa.gov, Bill.Precht@noaa.gov, Brendan.Bray@noaa.gov, Brian.T.Pawlak@noaa.gov, Chantal.Collier@dep.state.fl.us, charles.jabaly@dep.state.fl.us, Chris.Jeffrey@noaa.gov, colleen_charles@usgs.gov, Dan.Dorfman@noaa.gov, dondea@miamidade.gov, dpeter@wlf.la.gov, Emma.Hickerson@noaa.gov, Fan.Tsao@noaa.gov, Felipe.Arzayus@noaa.gov, gbrewer@usgs.gov, George.Schmahl@noaa.gov, Greg.Piniak@noaa.gov, Gregory.Boland@mms.gov, janice.duquesnel@dep.state.fl.us, Jeff.Hyland@noaa.gov, Jennifer.Koss@noaa.gov, Jennifer.Moore@noaa.gov, joanna.walczak@dep.state.fl.us, Joe.Schittone@noaa.gov, John.Cubit@noaa.gov, John.Embesi@noaa.gov, John.Hunt@myfwc.com, John.Mcdonough@noaa.gov, Kacky.Andrews@noaa.gov, karen_battle-sanborn@nps.gov, ksulak@usgs.gov, Lauri.Maclaughlin@noaa.gov, lcarver@wlf.la.gov, Margaret.W.Miller@noaa.gov, MaryElliott.Rolle@noaa.gov, patricia.cortelyou-hamilton@sol.doi.gov, Peter.Etnoyer@noaa.gov,

rob.ruzicka@myfwc.com, Shay.Viehman@noaa.gov, Steve.Gittings@noaa.gov, Tom.Hourigan@noaa.gov, Tom.Moore@noaa.gov, Vladimir.Kosmynin@dep.state.fl.us, Cheryl Woodley <Cheryl.Woodley@noaa.gov>, Ilsa Kuffner <ikuffner@usgs.gov>, Stephen Blair <BlairS@miamidade.gov>
Subject: **Shallow water coral - papers and cellular physiological responses**

Hi Shallow water coral group,
Please find attached several papers that have incorporated cellular physiological parameters in either coral or other organisms' health assessment, that may be of interest. Sorry for being slow getting these to the group, I have been mobilizing my staff for the Keys and will be traveling there today.
Best Regards
Cheryl

--
Cheryl Woodley, Ph.D.
Coral Health and Disease Program

DOC/NOAA/NOS/NCCOS
Center for Coastal Environmental Health and Biomolecular Research
Hollings Marine Laboratory
331 Fort Johnson Rd
Charleston, SC 29412
843.762.8862 Phone
[redacted] Fax
cheryl.woodley@noaa.gov

Marine Poll B....pdf (284 KB)

MEPS 2007 3...pdf (515 KB)

Ecotox 2010....pdf (526 KB)

Chapter 10 ...y.pdf (1.6 MB)

valdez paper...pdf (76.2 KB)

Kyowa Violet....pdf (410 KB)

Oil effects o....pdf (208 KB)

Begin forwarded message:

From: Steve LeGore <[redacted]@mindspring.com>
Date: May 28, 2010 3:50:13 PM EDT
To: vassil zlatarski <[redacted]@yahoo.com>, Coral-List <coral-list@coral.aoml.noaa.gov>
Subject: **Re: [Coral-List] Oil dispersants's effect on human health**
Reply-To: Steve LeGore [redacted]@mindspring.com>

Vassil,

These links will likely not provide the complete information you are seeking, but perhaps they will help.

http://www.valdezlink.com/corexit/media-c/lncom001.PDF_1.pdf

http://lmrk.org/corexit_9500_uscueg.539287.pdf

http://www.cleancaribbean.org/docs/COREXIT_9580_UsCuEg.PDF

http://lmrk.org/master_ec9527a_msds.539295.pdf

Steve

-----Original Message-----

From: vassil zlatarski <[redacted]>
Sent: May 28, 2010 5:30 AM
To: Coral-List <coral-list@coral.aoml.noaa.gov>
Subject: [Coral-List] Oil dispersants's effect on human health

Dear Coral-Listers,

What do we know about the effect of oil dispersants on human health and is the existing knowledge adequate for protection of human body? The question is actual for everybody working in waters treated with oil dispersant, especially for divers. Sorry for asking again, but no reply. Any contribution will be greatly appreciated.

Thanks in advance,

Vassil

131 Fales Rd., Bristol, RI 02809, USA; tel.:

____

Steve LeGore, Ph.D.
LeGore Environmental Associates, Inc.
2804 Gulf Drive N.
Holmes Beach, Florida 34217 USA
Tel: 941/778-4650
Fax: 941/778-4761
Cell: [redacted]
GMT + 4 hrs

____

Ref. No. [UMCES]CBL 08-095
Alliance for Coastal Technologies Indexing No. ACT-08-01

Workshop Proceedings

HYDROCARBON SENSORS FOR OIL SPILL PREVENTION AND RESPONSE

Seward, Alaska
April 8-10, 2008

Funded by NOAA through the Alliance for Coastal Technologies (ACT) with support from the Oil Spill Recovery Institute (OSRI)

An ACT Workshop Report

A Workshop of Developers, Deliverers, and Users of Technologies for Monitoring Coastal Environments:

Hydrocarbon Sensors for Oil Spill Prevention and Response

Seward, Alaska
April 8-10, 2008

Sponsored by the Alliance for Coastal Technologies (ACT) and NOAA's Center for Coastal Ocean Research in the National Ocean Service and the Oil Spill Recovery Institute (OSRI).

Hosted by ACT Partner Organizations, University of Alaska Fairbanks and the Alaska SeaLife Center.

ACT is committed to develop an active partnership of technology developers, deliverers, and users within regional, state, and federal environmental management communities to establish a testbed for demonstrating, evaluating, and verifying innovative technologies in monitoring sensors, platforms, and software for use in coastal habitats.

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Document ID: 0.7.19.301

Executive Summary

During April 8th-10th, 2008, the Alliance for Coastal Technologies (ACT) partner institutions, University of Alaska Fairbanks (UAF), Alaska SeaLife Center (ASLC), and the Oil Spill Recovery Institute (OSRI) hosted a workshop entitled: "Hydrocarbon Sensors for Oil Spill Prevention and Response" in Seward, Alaska. The main focus was to bring together 29 workshop participants – representing resource managers, scientists, and technology developers – together to discuss current and future hydrocarbon in-situ, laboratory, and remote sensors as they apply to oil spill prevention and response.

Hydrocarbons and their derivatives still remain one of the most important energy sources in the world. To effectively manage these energy sources, proper protocol must be implemented to ensure the prevention and response to oil spills, as there are significant economic and environmental costs when oil spills occur. Hydrocarbon sensors provide the means to detect and monitor oil spills before, during, and after they occur. Capitalizing on the properties of oils, developers have designed in-situ, laboratory, and remote sensors that absorb or reflect the electromagnetic energy at different spectral bands.

Workshop participants identified current hydrocarbon sensors (in-situ, laboratory, and remote sensors) and their overall performance. To achieve the most comprehensive understanding of oil spills, multiple sensors will be needed to gather oil spill extent, location, movement, thickness, condition, and classification. No single hydrocarbon sensor has the capability to collect all this information. Participants, therefore, suggested the development of means to combine sensor equipment to effectively and rapidly establish spill response.

As the exploration of oil continues in polar latitudes, sensor equipment must be developed to withstand harsh, arctic climates, be able to detect oil under ice, and reduce the need for ground teams because ice extent is far too large of an area to cover. Participants also recognized the need for the United States (U.S.) to adopt a multi-agency cooperation for oil spill response, as the majority of issues surrounding oil spill response focuses not on the hydrocarbon sensors but on an effective contingency plan adopted by all agencies. It was recommended that the U.S. could model contingency planning based on other nations, such as Germany and Norway.

Workshop participants were asked to make recommendations at the conclusion of the workshop and are summarized below without prioritization:

- Outreach materials must be delivered to funding sources and Congressional delegates regarding the importance of oil spill prevention and response and the development of proper sensors to achieve effective response.
- Develop protocols for training resource managers as new sensors become available.
- Develop or adopt standard instrument specifications and testing protocols to assist manufacturers in further developing new sensor technologies.

- As oil exploration continues in polar latitudes, more research and development should be allocated to develop a suite of instruments that are applicable to oil detection in or under ice.
- Develop a standard GIS data management protocol to be implemented so that data can feed directly into the Maritime Domain Awareness or Dynamic Decision Support System (DDSS).
- Resource managers proposed that hydrocarbon sensors undergo performance standards to ensure global compliancy. It was recommended that ACT, working with various developers/manufacturers, test the ability to measure hydrocarbons on water and under ice using both in-situ and remote sensing technologies.
- Resource managers and technology developers should revisit funding sources and explore novel approaches towards obtaining necessary support.

Alliance for Coastal Technologies

The Alliance for Coastal Technologies is a NOAA-funded partnership of research institutions, resource managers, and private sector companies dedicated to fostering the development and adoption of effective and reliable sensors and platforms. ACT is committed to providing the information required to select the most appropriate tools for studying and monitoring coastal environments. Program priorities include transitioning emerging technologies to operational use rapidly and effectively; maintaining a dialogue among technology users, developers, and providers; identifying technology needs and novel technologies; documenting technology performance and potential; and providing the Integrated Ocean Observing System (IOOS) with information required for the deployment of reliable and cost-effective networks.

To accomplish these goals, ACT provides these services to the community:

- Third-party testbed for quantitatively evaluating the performance of new and existing coastal technologies in the laboratory and under diverse environmental conditions.
- Capacity building through technology-specific workshops that review the current state of instrumentation, build consensus on future directions, and enhance communications between users and developers.
- Information clearinghouse through a searchable online database of environmental technologies and community discussion boards.

ACT is organized to ensure geographic and sector involvement:

- Headquarters is located at the UMCES Chesapeake Biological Laboratory, Solomons, MD.

- Board of Directors includes Partner Institutions, a Stakeholders Council, and NOAA/CSC representatives to establish ACT foci and program vision.

- There are currently eight ACT Partner Institutions around the country with coastal technology expertise that represent a broad range of environmental conditions for testing.

- The ACT Stakeholder Council is comprised of resource managers and industry representatives who ensure that ACT focuses on service-oriented activities.

The ACT workshops are designed to aid resource managers, coastal scientists, and private sector companies by identifying and discussing the current status, standardization, potential advancements, and obstacles in the development and use of new sensors and sensor platforms for monitoring, studying, and predicting the state of coastal waters. The workshop's goal is to help build consensus on the steps needed to develop and adopt useful tools, while facilitating critical communication among the various groups of technology developers, manufacturers, and users.

ACT Workshop Reports are summaries of the discussions that take place between participants during the workshops. The reports also emphasize advantages and limitations of current technologies while making recommendations for both ACT and the broader community on the steps needed for technology advancement in the particular topic area. Workshop organizers draft the individual reports with input from workshop participants.

ACT is committed to exploring the application of new technologies for monitoring coastal ecosystem and studying environmental stressors that are increasingly prevalent worldwide. For more information, please visit www.act-us.info.

Hydrocarbon Sensors for Oil Spill Prevention and Response Workshop Goals

Planning for the ACT Workshop on hydrocarbon sensors was undertaken with the following objectives in mind:

- to identify and summarize current hydrocarbon sensors in the in-situ, laboratory, and remote sensing fields pertaining specifically to oil spill prevention and response;
- to elucidate the strengths and limitations of each type of hydrocarbon sensor;
- to discuss the expected resource manager needs from hydrocarbon sensor technology and scientists to ensure proper management, funding, and action;
- to determine future hydrocarbon sensor technology that would enhance oil spill detection and response;
- to make recommendations and priorities for ACT and the broader community to pursue.

Organization of the Workshop

The two-day workshop was co-sponsored by ACT and OSRI and hosted by ASLC and UAF as ACT partner institutes. The workshop was organized by Dr. Shannon Atkinson (UAF) and Dr. Scott Pegau (OSRI). A stakeholder committee was assigned, which included Dr. Buzz Martin, Ms. Chelsea Donovan, and Dr. Guy Meadows. Dr. Robert Shuchman was later assigned to the committee to replace Dr. Meadows.

On the first evening, workshop participants convened for a reception and dinner in the Alaska SeaLife Center's Underwater Viewing area. Dr. Shannon Atkinson delivered the workshop's opening remarks, along with a brief introduction about ACT and its mission. Discussing the importance

of under ice hydrocarbon detection using Ground Penetrating Radar (GPR) techniques was the topic of the workshop's keynote address presented by Mr. Lee Majors of Alaska Clean Seas.

The workshop commenced the following day with an introduction by Dr. Scott Pegau (OSRI) and a series of presentations delivered by the stakeholder committee members. These presentations included: 1) A summary by Ms. Chelsea Donovan of the most recent and available hydrocarbon technologies; 2) Special Monitoring of Applied Response Technologies (SMART) as discussed by Dr. Buzz Martin; and 3) The future of hydrocarbon technologies by Dr. Robert Shuchman. Workshop participants were then classified according to user group (technology developer, scientist, or resource manager) for the morning and afternoon breakout sessions.

Prior to the workshop, participants were given breakout session questions that served as the framework for discussion. Breakout sessions were pre-assigned based upon two categories of hydrocarbon technologies. The first morning session focused on in-situ and laboratory technologies, and the afternoon session concentrated on remote sensing technology. To maintain discussion consistency, the same breakout session questions were administered for both morning and afternoon sessions. Workshop participants were randomly assigned to three designated conference rooms at ASLC. To foster open and unique dialogue among workshop participants, user groups were integrated within each conference room. A stakeholder committee member served as moderator in each of the designated conference rooms. Following both breakout sessions, each group reported their findings in a plenary session.

Breakout Session Questions (Morning and Afternoon Sessions)

In-Situ, Laboratory, and Remote Sensing Technologies

- What hydrocarbon sensors are currently available?
- What do the sensors measure, and what does this information mean?
- What are their limitations and strengths?
- What do resource managers need from hydrocarbon sensors?
- What are the expected future needs?
- What needs to be done to ensure new sensors are accepted by the resource management community?
- What are the challenges from a development standpoint to design hydrocarbon technologies?
- Are there other approaches and/or technologies that are worth pursuing?

On the final day, workshop participants met for a third breakout session discussing the future of hydrocarbon technologies as they relate to oil spill prevention and response. Breakout session questions for this particular session were distributed prior to the workshop and served as the framework for discussion. Stakeholder committee members led a panel discussion with all workshop participants present. During this session, participants were also asked to discuss recommendations and priorities for ACT to pursue.

Breakout Session Questions (Final Session)

Vision and Future Developments

- What areas of research and development are most needed?
- What actions are needed within the next year?
- What actions are needed within the next 3 years?
- How might we achieve the needed actions?

Hydrocarbon Sensor Background

Hydrocarbon derivatives have remained one of the world's most important energy sources since the 19th century. They have helped establish global economies, drive industrialization, and fuel transportation and heating needs to even the most remote regions on the planet. The global dependence for hydrocarbons, a non-renewable resource, has triggered a growing demand that has entrenched itself within political, socio-economic, and environmental arenas. As a result, technological advancements in areas of exploration, extraction, monitoring, detection, and refinement must meet this global demand while also reducing potential environmental consequences.

Whether extracting crude oil, refining the product, or transporting hydrocarbon derivatives, there is an inherent risk that oil spills will happen and continue to occur. Oil spills may occur in many environments, as oil exploration and development can be found both terrestrially and aquatically. These environments include the nearshore, offshore, under snow and sea-ice, on land, estuarine, and riparian habitats. Additionally, hydrocarbon derivatives are often transported overseas making long trans-Atlantic and trans-Pacific journeys over ecologically sensitive areas. Oil spill incidents surrounding oil tankers, however, occur at relatively low frequencies when compared to annual global oil spills. Worldwide, fuels account for 48% of the total oil spilled into the sea worldwide, while crude oil spills account for 29% of the total (Brekke and Solberg, 2005). Most oil spills are diesel and hydraulics, which are aromatic hydrocarbon compounds that generally do not sink in the water column.

Discharged oil on water is classified as an oil spill, slick, or sheen in descending order of magnitude. As time passes and with increased wave and wind action, oil spills will disperse and gradually degrade. Heavier oils such as crude oil, for example, persist in the environment much longer than lighter oils that typically evaporate. Though not as toxic as lighter oils, crude oil has far greater environmental consequences associated with it, as it can directly and indirectly impact multiple trophic levels such as phytoplankton, benthic invertebrates, fish, marine mammals, and sea birds.

Federal, State, and industry standards of prevention and response have shown significant improvements over the past 20 years stemming largely from incidents surrounding the 1989 Exxon Valdez Oil Spill. In 1990, Congress passed legislation in the form of the Oil Pollution Act of 1990 (OPA 90) to improve oil spill prevention and response. The OPA expanded federal funding and resources to facilitate oil spill response, established new requirements for national and industry contingency plans, imposed stricter penalties for improper oil discharge, and maintained State authority to establish law governing oil spill and response (EPA 1990).

An equally important aspect to spill response, aside from prevention, is the mechanism(s) by which hydrocarbons are detected at the onset of a spill. There are a suite of hydrocarbon sensors designed to accommodate in-situ, in-vitro, and remote sensing methods of oil spill detection. However, no single, current hydrocarbon sensor has the capability of providing all the information required for oil spill contingency planning (Jha et al., 2008). As a result, resource managers and scientists must depend upon multiple technologies to arrive at sound, effective management.

Hydrocarbon detection in water has remained largely unchanged since the 1970s despite the advancements of different sensor technologies. Sensors are continuing to detect electromagnetic energy absorbed, reflected, and fluoresced across different wavelength spectrums or utilizing mass spectrometry to fingerprint oil. Depending upon the sensor used, one can detect the absorption, reflectance, and fluorescence by hydrocarbons at different wavelengths within the electromagnetic spectrum. Remote sensing has shown vast improvements since thermal, visible, and aerial scanning and photography systems were used at the start of the 1970s (Jha et al. 2008). Yet these remote scanning systems still utilize some of the same principles of detecting oil in water. Electromagnetic absorption and emission remain as one of the most effective ways to determine the presence of oil either remotely or in-situ.

For the purpose of this workshop, participants were asked to focus their efforts upon hydrocarbon sensors that provide immediate, rapid response for sea-ice, snow, and water-related oil spills; estuarine, nearshore, offshore, and riparian environments were considered water-related. Land-based oil spills were not addressed in this particular workshop, as response and contingency planning differs from that of under ice and water-related oil spills. Additionally, because the term "hydrocarbon" encompasses multiple compounds and derivatives making its definition complex, participants defined "hydrocarbon" for this particular workshop as both crude and refined oil products. Hydrocarbon sensor discussions, therefore, were not compound-specific, but rather addressed hydrocarbons in the broad contextual sense.

It should be noted that there was general consensus among all workshop participants that in order to determine the most effective hydrocarbon technologies for oil spill prevention and response, there was no endorsement of any specific instrument or developer.

Current Hydrocarbon Sensor Technologies: In-Situ, Laboratory, Remote Sensing

In-Situ and Laboratory Sensors

In-situ sensors were defined as any sensor that makes direct contact with the oil or the media that the oil is in. Laboratory sensors and only in-situ sensors that were classified as rapidly deployable were listed in Table 1. Much of the hydrocarbon sensor technology revolves around oil's electromagnetic absorption and emission of energy through different wavelengths within the electromagnetic spectrum. These include the visible, infrared, ultraviolet, radio wave, and microwave wavelengths. Listed are general types of hydrocarbon sensors and, therefore, have no specific endorsements, evaluation, or quantitative comparison. Cost was an exclusionary factor for either strength or weakness considerations, as cost can be subjective and relative.

Remote Sensing Technology

Remote hydrocarbon sensors were defined as sensors that are not in direct contact with oil or media that the oil is in. These technologies included airborne and satellite-based remote sensors. Another classification that participants used was “near” and “far” range forms of indirect measurement. Remote sensing technology enables first response units to continuously track and stay on the oil for proper containment. Additionally, with the exception of Synthetic Aperture Radar (SAR), remote sensing can be recorded in real-time—SAR has this capability but is costly. Listed in Table 2 are general types of hydrocarbon remote sensors and, therefore, have no specific endorsements, evaluation, or quantitative comparison. Cost was an exclusionary factor for either strength or weakness considerations, as cost can be subjective and relative. Jha et al. (2008) also provides a good review on current remote sensing technologies for oil spill disaster management

Resource Manager Needs

To properly assess the extent and magnitude of oil spills, there is a suite of criteria needed for resource managers to obtain and monitor before, during, and after the spill has occurred. Synthesizing these data, however, proves challenging, as information is being compiled from both in-situ and remote sensing hydrocarbon sensors. To date, there is no composite hydrocarbon sensor that accommodates multiple, continuous, real-time data for resource managers to use. Rather, they must draw from multiple hydrocarbon sensor technologies to arrive at proper contingency planning. Workshop participants discussed the most important resource manager needs for proper oil spill response (i.e., burning, dispersants, etc.). Their criteria are listed below and include sensor data requirements and specifications:

Detection

Sensors must be able to detect the presence and/or absence of oil in areas where there are potential oil discharges. In addition, resource managers want to detect the amount of oil that is not only at the surface but is mixed in the water column. Many in-situ and remote hydrocarbon sensors detect wavelengths of electromagnetic energy either absorbed or reflected by oil in the infrared, visible, microwave, and ultra-violet spectrums. Limitations arise, however, when penetrating fog or conducting night observations—concerns that are especially important to resource managers located in northern latitudes.

Location

Sensor technologies must be able to determine the location of the oil spill. This is perhaps the single most important data point for resource managers to acquire. Response techniques may differ depending upon the location of the spill (i.e., nearshore, offshore, riparian, under ice, etc.).

Spatial Extent and Thickness

Knowing the discharge area alone can vastly underestimate the extent of the oil spill as 90% of the oil is generally found within 10% of the spill area. Combining both area and thickness will deter-

mine the best available technologies for response in different locations. Understanding these volumetric constraints also yields a better approximation of the quantity of oil discharged—another data point essential for resource managers. It was recommended that repeated thickness measurements be obtained due to the dynamic and fluid nature of oil on water.

Viscosity

Viscosity describes the overall fluidity of a particular substance. Heavier oils are more viscous (i.e., less fluid) than lighter hydrocarbons, such as methanol, acetone, and benzene; and thus require more time and surface wave action to breakdown and disperse. Knowing the viscosity of the discharged oil will determine the appropriate response mechanisms to be deployed.

Movement and Tracking Over Time

Discharged oil on water is a fluid, dynamic substance that responds to environmental and oceanographic change. Resource managers must be able to track the movements of oil on water and under ice—especially in either populated or ecologically sensitive nearshore habitats—in real-time capabilities.

State of the Oil

Oil is made up of many complex hydrocarbon chemicals. Each chemical compound responds differently to the environment and degrades at various rates. Sunlight, microbes, and wave action, for example, can all profoundly impact oil composition over time. Oil degradation or "weathering" is the process from which oil loses its resemblance to a state of unspilled oil. It is important for resource managers to continuously know the state of spilled oil as it weathers or if there is chance for recovery.

ID Classification (Oil Fingerprinting)

Using forensic techniques, resource managers and scientists have the ability to determine the source of oil spills in the natural environment. Hydrocarbons have specific chemical signatures or fingerprints that reveal its specific chemical origins and geological processes it has undergone. Crude and refined oils, therefore, have their own unique fingerprint. Not only does this provide a framework for issuing proper contingency plans because it identifies what type of oil is present, but it also aids in legal ramifications when determining perpetrators of oil spills.

Sensor requirements

The aforementioned criteria discuss the variables in-situ and remote sensors must be equipped with in order to properly respond to oil spills. How sensors are packaged, however, is yet another set of criteria that workshop participants discussed. The SMART protocol provided much of the context on how sensors should be packaged (Appendix B).

Remote sensing and in-situ hydrocarbon technologies must collect data in real-time format and be accessible to first responders and resource managers. The overall consensus was to have inexpensive, portable, and rugged units that can be deployed by first responders. These units must be rap-

idly deployable and extremely reliable such that they can be switched on after inactivity for many years. Hydrocarbon sensor technologists should also begin exploring the combination of multiple sensors on one platform. Because multiple users will operate these sensors, they need to be simple, have sufficient operating instructions, and be operational for up to 6 hours.

With respect to remote sensing systems, they must provide good coverage, discern extent and thickness of oil, and be able to collect data at night and through fog conditions. It was also suggested that these instruments be linked via GIS and have a web-based interface to remotely access data. Remote sensors require more robustness, being field deployable, display a 3D image, and possess stronger resolution capabilities. Reducing the amount of false positives in oil spill detection was another key component to making remote sensing more applicable.

User Friendly Instrumentation and Interpretation

Different users, such as first responders, resource managers, and scientists, utilize hydrocarbon sensors to effectively prevent, detect, and manage oil spills. Vitally important is the ability for these users to understand how to use the equipment and, secondly, interpret the data the sensors are collecting. With the advent of more sophisticated remote sensing equipment, resource managers have urged the implementation of training tools to instruct the use of them, the capabilities of this equipment, and the interpretation of results.

Data Integration

Resource managers utilize multiple hydrocarbon sensors to determine the most effective and necessary response and contingency plans. Participants discussed the need for in-situ technologies and remote sensing capabilities to be integrated, such that managers have a single interface from which to view data. Suggestions for such integration included georeferencing and entering this information into a real-time Geographic Information System (GIS) interface that could later feed into the national plan to achieve Maritime Domain Awareness. Maritime Domain Awareness (MDA) has been defined as, "the effective understanding of anything associated with the global maritime domain that could impact the security, safety, economy, or environment of the United States," (DHS, 2005). Another integration tool beginning to emerge is the use of Dynamic Decision Support Systems (DDSS) to identify, classify, and remediate oil spills. Dynamic Decision Support Systems utilize a new generation of smart autonomous in-situ sensing buoys, remote sensors, and background GIS layers describing biological and oceanographic parameters (Shuchman and Meadows, 2008).

Developmental Challenges Toward Oil Spill Prevention and Response

Workshop participants identified two types of challenges that have prohibited quick, effective oil spill response: sensor technology issues and execution challenges. Both are addressed within the broad context of developmental challenges to oil spill response.

Workshop participants emphasized that the difficulties with oil spill response was not the technological means of gathering information. Remote and in-situ sensors have been performing to

their abilities, but scientists and resource managers would like to begin seeing the development of integrated sensors that can perform multiple variable testing. To accomplish this task, however, developers noted that to integrate sensors would require immense startup costs and would not become a portable, rugged, repeatable, and easy-to-use option for many years. The Slick Sleuth sensor, for example, has multiple sensors and linked with a GIS interface, but the equipment is still in the research stages and not ready for quick oil spill response. The instrument is still far too large for first response units. Real-time GIS integration was another sensor challenge in the U.S. that has impeded the full potential of quick response. The general complaint was that, without a GIS interface, by the time the data processing is done, the data are no longer relevant.

Current sensor technology provides an overload of data that proves difficult for first responders and resource managers to synthesize into means of quick response. To develop sensors that are more "user-friendly" would require a longer research and development stage. Climate and location also play an important role in the developmental stages of sensors and can pose serious limitations in extreme environments. Power, calibration, sensitivity, and biofouling are other problematic concerns, especially with portable in-situ hydrocarbon sensors.

Oil spill response challenges at the broad management level in the U.S. include insufficient funding, multi-agency responsibility, environmental legislation, and federal aviation protocols. To combine sensor technologies with integrated GIS interfaces would be incredibly expensive to develop for such a small market of users. Funding for oil spill response continues to be one of the largest challenge for proper oil spill response in the U.S. Funding for oil spill prevention and response has remained largely in the form of prevention. The oil spill response industry is not a driver of technology development. Federal agencies must realize the "real cost" of responding to an oil spill before sound funding is allocated to effective technology and subsequent response. To date, the U.S. has not maintained a consistent approach towards oil spill response. This is due in large part because of multi-agency responsibility and accountability at the State and Federal levels for oil spill response. Too many agencies are involved within the U.S. to make quick, effective decisions. There is no common approach to response adopted in the U.S. Cohesion among agencies could be modeled after foreign countries, such as Germany and Norway, where standardized protocols have been adopted in the form of the Bonn Agreement. Foreign strike teams employ aircrafts that are not used only for spills but for surveillance as well and are equipped with hydrocarbon sensors, such as Side –Looking Airborne Radar (SLAR) and Infared/Ultraviolet (IR/UV) remote sensors, all integrated with GIS interfaces. Perhaps due to multi-agency complications or the size of the U.S. coastline, the regional availability of sensors is limited, and no effective means of capitalizing on existing air patrols for oil spill detection and monitoring has occurred. Additional setbacks arise when new technology is to be equipped on fixed wing or non-fixed wing aircraft. Supplemental Type Certificates (STC) must be filed and approved, which may take 3-4 weeks. This delay may impede proper contingency planning should a spill occur within that time period. The fractured approach to spill response means that no group is able to afford the more expensive technologies. It also slows the incorporation of new technologies that require trained users.

Environmental legislation has also impeded the ability for the U.S. to conduct sufficient and adequate tests of new technologies in the field. Foreign countries have less stringent legislation surrounding the testing of sensor equipment in oiled waters. Due to the Clean Water Act (CWA) and OPA 90, scientists cannot intentionally spill oil in U.S. waters to test the efficacy of new oil

detection technology. In other countries, however, abilities to do such testing have been more successful.

Vision and Future Developments

In a round table discussion, workshop participants discussed the future of hydrocarbon sensors as they relate to oil spill response. Participants also sought the opportunity to discuss programmatic objectives that may also contribute to the improvement of oil spill detection and response. The original premise was to discuss foreseeable action within one year and three years, respectively. As discussion unfolded, it was apparent that most development ideas would require significant research and development that would exceed the one-year criteria.

As oil exploration continues in the polar latitudes, the need for hydrocarbon sensors to detect oil under ice will become increasingly important. Hydrocarbon sensors in this harsh environment must be rugged, portable, and have low false alarm rates. Remote monitoring devices should cover greater area and volume and, in the future, replace field-based crews after proper ground-truthing has been conducted. Ground Penetrating Radar (GPR) has begun to show promise in the Arctic, but further research and development is needed to make this into a functional remote monitoring sensor.

One of the key areas participants concentrated their discussion was the development of various platforms for hydrocarbon sensors. These included both stationary and mobile platforms for in-situ monitoring and detection. Existing U.S. Coast Guard buoys and channel markers were deemed a viable stationary platform that could have in-situ fluorometry devices attached to them, but these units would have to be mass produced at a relatively low cost. It was suggested that these sensor platforms could be concentrated around large harbors that are equipped with unmanned aerial vehicles (UAVs) deployable via satellite or aircraft uplink, albeit at substantial cost. In-situ mass spectrometers detecting oil thickness need to improve their range of detection to include centimeters to nanometers.

Mobile platform discussion included the attachment of hydrocarbon sensors on large ocean-going vessels, the development of autonomous underwater vehicles equipped with hydrocarbon sensors, and nanotechnology that would allow sensors to be deployed within the oil slick to track movements. University of Michigan has been developing several autonomous vehicles, such as the BathyBoat, Flying Fish, and the Automated Lagrangian Water Quality Assessment System that could have hydrocarbon sensors attached with GPS interfaces built in. Helikites have also been developed that are either helium driven or pulled behind a vessel. Difficulties in autonomous vehicles arise in polar latitudes, however, as their reliability is reduced because of the extreme operating conditions. The application of remotely operated underwater vehicles (ROVs) should be explored further in polar latitudes, as they provide an opportunity to explore under the sea ice. ROVs could be manned with various hydrocarbon sensors that measure extent and thickness.

Tracking the movements of oil could be accomplished using sensors that either float on the oil's surface or be imbedded within the oil. Multiple sensors of this nature could be deployed quickly and effectively and reduce the need for continuous monitoring of oil spill movements. The Argo-

sphere drifter developed by Norwegians has the capability to float and stay with oil slicks tracking movements and thickness. The other option would be to develop nano-sensors that could be imbedded within the oil. These could potentially have a Radio-frequency (RF) tag, such as a RF cavity resonator with an oleophilic sensor. The ability to track and monitor oil mineral aggregates (OMA) was also discussed. To accomplish this, participants recognized the need to have field based epifluorescence monitors that detect small droplets of oil possibly in the surf zone and determine if the aggregate is efficiently absorbing the oil.

Future sensor development focused primarily on remote sensing capabilities, but there were some novel approaches to in-situ technology. In-situ bioavailability and underwater in-situ techniques utilizing different marine species, such as filter-feeding mussels or phytoplankton, may serve as means for oil spill detection. Improvements in beach probing were also suggested as this is one of the primary methods of detecting oil along shorelines. Flow cytometry that determines oil spill size and flow has now become an in-situ method of detection, but further research is needed in this application. Time delay fluorescence is another method of detection that may help tease apart different components within the oil compounds. There was also a recommendation to manufacture a “sensor suitcase” that would have the necessary sensors to implement proper oil spill contingency planning. This suitcase model would be rapidly deployable, rugged, and have the robustness to withstand years of non-use. Resource managers and scientists also recommended that in-situ sensors be equipped with an adapter that GPS devices could be plugged into. Remote sensor development included the testing of GPR, Lidar scattering sensors, laser fluorescence technology, Nuclear Magnetic Resonance (NMR), SAR, Radar SAR II, and interferometric and polarimetric technologies.

Warranting further discussion during the Vision and Development Breakout Session was having an integrated approach towards oil spill detection and response. This was discussed at the programmatic level of multi-agency cooperation within the U.S. and the development of hydrocarbon sensor combinations. Federal and State agencies should begin piggybacking on existing surveillance and patrol missions to monitor oil spills as foreign countries such as Germany have implemented. Accessibility to data sets should also be integrated within Federal and State agencies forming multi-user oil reference libraries. First response strike teams assessing proper oil spill response should also be formally trained in the operation and use of existing and future hydrocarbon technologies.

Workshop Recommendations

Resonating throughout the workshop was the immediate and long-term need to integrate in-situ, laboratory, and remote hydrocarbon sensors in the U.S. There are many different sensors and manufacturers that ultimately measure similar variables pertaining to hydrocarbon discharge, but lacking is an effective method to bring all this information together. This issue is further compounded due to the fact that there are multiple agencies involved with detecting oil spill discharge within U.S. waterways. During the final breakout session, workshop participants devised other key recommendations for ACT and the broader community to implement that addressed both short-term and long-term objectives. These recommendations are bulleted below:

Outreach Initiatives:

- It is recommended that ACT and workshop organizers distribute either the Executive Summary or Workshop Proceedings to national and international oil spill conferences, such as the International Oil Spill Conference. Additionally reports should be provided to Congressional delegates, The US. Arctic Commission, the Regional Citizen's Advisory Councils (Prince William Sound and Cook Inlet and the Arctic Council for Emergency Preparation, Prevention, and Response (EPPR).
- Further dialogue between resource managers, scientists, and developers need to take place to find the most effective means to develop composite sensors integrated with georeferencing or GIS interfaces.
- As new in-situ and remote sensing technologies come available, a consistent approach to use of spill sensors for training resource managers and first responders on the use and interpretation of the data collected must be administered.
- Submit proceedings to appropriate funding sources, such as Exxon Valdez Oil Spill Trustee Council (EVOSTC) and OSRI.

• As oil exploration continues in polar latitudes, more research and development should be conducted to develop a suite of instruments that are applicable to oil detection in or under ice. Stemming from developments, such as GPR, it would be ideal to develop a remote system that could be performed without significant ground-truthing. Putting personnel on sea ice can be dangerous and is often not the quickest way to respond. Technologies that would measure dynamic ice conditions, be helicopter-based, and cover large areas are at least three years from deployment and would most likely include either GPR or NMR.

• It is recommended that a standard GIS data management protocol be implemented that can feed directly into the Maritime Domain Awareness or DDSS. Further development should also be explored into making these data management portals internet accessible, (web-based) such that first responders and resource managers can enter and manipulate data in real-time. This would also reduce the amount of personnel required to be onsite.

• Currently, there is no common approach to oil spill response in the U.S. Perhaps the U.S. can draw from protocols issued by the Bonn Protocol.

• Resource managers proposed that hydrocarbon sensors undergo performance standards to ensure global compliancy. This would also allow for hydrocarbon sensor technologies to be evaluated and compared for different response scenarios and deployment locations. To obtain a level of standardization, the American Society of Testing Materials (ASTM) or ACT could test hydrocarbon technologies. Although methods of data collection may vary depending upon which in-situ or remote sensing equipment is used, ACT may be able to undergo broad in-situ and remote sensing evaluations. Expanding upon this recommendation may include the certification of new sensor technologies by a lab, possibly ACT or Ohmsett, the National Oil Spill Response Test Facility, in an underwriting capacity. NOTE Ohmsett will test and evaluate equipment and sensors but will not certify equipment or sensors. They only certify the test data and results provided to their customers.

• One of the first efforts towards standardization would be to adopt protocols that have already been administered, such as by the Europeans or by SMART in 2006.

- It was recommended that ACT, working with different developers/manufacturers, evaluate the ability to measure hydrocarbons on water and under ice using both in-situ and remote sensing technologies. It is important to examin how these sensors perform under these conditions.
- Develop in-situ tracking devices such as drifters, buoys, and helicopter-deployed grabbers that sample oil to help identify and track oil discharge movements. Discussion also surrounded the improvements of fluorescent dyes that are passive and can bind directly to the oil. All of these help identify where sensors should be targeted, although they are technically not sensors themselves.
- Resource managers and developers should revisit funding sources and explore novel approaches towards obtaining necessary monies. Suggestions included writing grants to the Office of Technology's Small Business Innovative Research (SBIR) Program and Small Business Technology Transfer (STTR) Program. Another novel approach would be to make the polluters pay for either new technologies or the integration of existing technologies.

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References

Brekke, C. and A. Solberg. 2005. Oil spill detection by satellite remote sensing. Remote Sensing of the Environment 95: 1-13.

Chase, C. R. and S. V. Bibber. 2006. Utilization of automated oil spill detection technology for clean water compliance and spill discharge prevention. Freshwater Spills Symposium (FSS). Portland, Oregon. 15 pgs.

Department of Homeland Security. 2005. National plan to achieve maritime domain awareness for the national strategy for maritime security. 28 pgs.

Environmental Protection Agency. 1990. Oil Pollution Act. 66 pgs.

Jha, M. N., Levy, J., and Y. Gao. 2008. Advances in remote sensing for oil spill disaster management: State-of-the-art sensors technology for oil spill surveillance. Sensor 8: 236-255.

Shuchman, R. A., and G. A. Meadows. 2008. Future Hydrocarbon Technologies. Hydrocarbon Sensors for Oil Spill Response Workshop. Presentation.

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Appendix B: Hydrocarbon Sensors for Oil Spill Prevention and Response Workshop Participants

Appendix C: Current In-Situ and Laboratory Hydrocarbon Sensors Currently Used

Table 1: Current *In-Situ* and laboratory hydrocarbon sensors currently used by resource managers and scientists. Qualitative assessments of their performance is provided.

Hydrocarbon Sensor Type	Measurement	Information Provided	Strengths	Weaknesses
Fluorometer	Detect the presence of oil by excitation and the measurement of light absorbed vs. emitted. For this instrument, oils typically absorb light in the ultraviolet spectrum (300 and 400nm), and emit light in the visible spectrum (450 to 650nm range; (Chase and Bibber, 2006).	Detects presence/absence of oil, oil classification or oil fingerprinting, and concentration; analysis range is low ppm.	Rugged, easy to use, no sample prep time required, portable and in-line analyzers most commonly used and available thereby increasing consistent evaluations; single and multiband detectors.	Calibration issues because there are multiple compounds in the water column emitting energy; back scattering and potential false positves; you have to know what is in the water column before sampling for oil; cannot identify specific hydrocarbons such as aliphatic vs. aromatic hydrocarbons.
Fourier Transform Infrared (FTIR) Spectrometer	Laboratory technique that utilizes the absorption and emittance of electromagnetic wavelengths (similar to fluorometer) in the infrared spectrum.	Evaluates the condition of the oil such as the degree of oxidation, nitration, and soot content, presence/absence, oil fingerprinting, concentration.	Precise measurement method with no external calibration, rapid screening, increased sensitivity.	Non-portable and mainly a laboratory tool.
Turbidity Meters	Measures how much light is diffracted from particulates in the water column.	May show the prescence or absence of oil.	May be a primary tool to detect oil but their applications are severely limited.	Provides a very esoteric number because turbidity can be subjective; cannot differentiate between oil and other particulate matter.
Mass Spectrometers	Measures the mass to charge ratio of charged particles which generates a mass spectrum representing the masses of sample components.	Determines relative concentrations of oil compounds; presence/absence; oil classification.	Easy to use; classify oil; field portable; rugged; underwater sampling capabilities; underwater and in air; waterproof.	Difficulty to interpret; extensive training is required; analysis range is ppb; high resolution only.
Total Organic Vapor Monitors	Detects dissolved carbon in air and has the potential to detect volatiles.	May detect presence of oil compounds and some oil identification with calibration charts.	Saftey, field rugged, well accepted, easy to use, portable.	Performance degrades in cold weather; have to be aromatically detected; battery life in cold climates; analysis range is ppm.
Particle Size Analyzer	Determines the distribution of sizes in a sample of particulate material using modern, static light scattering instruments.	Oil droplet size; relative abundance of particles as surface size; concentration and the ability to differentiate between sediment.	Strong lab acceptance.	Not rugged or field-tested. Available Commerically.
Toxic UV & IR Absorption	Different sensors that detect the aborption of oil through different wavelengths within the electromagnetic spectrum, specifically UV and IR frequencies.	Detects presence/absence of oil; can follow thickness of oil.	Contact sensors good for leak detection; groundwater capabilities.	Not as rugged; calibration is user specific; misses some compounds (i.e. alcohols); low resolution.
Radiofrequency Absorption and Detection	Electromagnetic absorption within the radiowave wavelength part of the spectrum.	Detects presence/absence and abundance of oil; thickness up to 25mm.	Easy to use: easy detection system with will detect presence up to 25mm thick; good in ports; have solar panels attached providing good battery life.	Cannot detect with a high oil flow; 6ft seas or more and unit loses quality; depth limitations (cannot see underneath oil greater than 8 inches)
Imaging Sensors (Optical, Thermal) equipped on ROVs or AUVs)	More of a sensor platform but Remotely Operated Vehicles (ROVs) or Autonomous Underwater Vehicles (AUVs) may be equipped with different electromagnetic sensors.	Detects presence/absence; aerial extent; thickness via color scale method of detection; quantity; recoverability.	Relatively abundant; can be used under sea ice; easy to use.	Some ROVs and AUVs are only equipped with optical tools and thereby do not have quantitative evaluations; need expertise in interpreting information in sea ice condictions as few indiviuals have visually observed under sea ice.

APPENDIX D: REMOTE SENSING SENSORS AND THEIR QUALITATIVE ASSESSMENTS

Table 2: Current remote sensing hydrocarbon sensors currently used by resource managers and scientists. Qualitative assessments of their performance is provided.

Hydrocarbon Sensor Type	Measurement	Information Provided	Strengths	Weaknesses	Remarks
Side Looking Aerial Radar (SLAR)	Detects electromagnetic energy that is reflected by capillary microwave waves on the ocean and measures the backscatter from the ocean's surface. Oil dampens the amphitude of the capillary waves hence, these sensors detect the calming of the ocean's surface.	May potentially show the presence/absence of oil; location and extent of oil spill.	All-weather; far range (40km radius); processing time; high resolution; big picture; day and night monitoring; can detect through clouds, rain and fog.	Cannot detect oil if in calm seas (i.e. cannot detect calm inside of calm); sea state limitations (between 0.5-7 on the Beaufort scale); potential for false positives (i.e. wave or algal blooms, biogenic substances); no thickness detection; needs proper ground truthing.	Airborne platform; most common radar method of detection.
Synthetic Aperture Radar (SAR)	Same as above.	May potentially show the presence/absence of oil; location and extent of oil spill.	All-weather; exptreme far range; high resolution; big picture; day and night monitoring; can detect through clouds, rain and fog.	Cannot detect oil if in calm seas (i.e. cannot detect calm inside of calm); sea state limitations (between 0.5-7 on the Beaufort scale); potential for false positives (i.e. wave or algal blooms, biogenic substances); no thickness detection; needs proper ground truthing.	Airborne and satellite platform common radar method of detection; far range capability.
Laser Fluorosensors which include Light Detection and Ranging (LIDAR) sensors	Illuminates the ocean surface with a UV laser oil absorbs and emits electromagnetic energy in the form of visible light.	Oil classification; thickness of 0.1-20µm; if a scanning device is attached, one can determine aerial extent and volume; detects presence/absence.	Course oil classification; distinguish between natural oil, biogenic oil, mineral oils, etc.; does not need a specialized aircraft; day and night monitoring; transect of points instead of sampling; potential for submerged oil.	Has to be operated in low altitudes; cannot detect through fog and cloud cover; limited to sea state; can only detect oil spill on the surface water (i.e. must obtain an oil sample to calculate thickness); thermal acclimation of oil; needs proper ground truthing .	Airborne; laser acoustic sensors are available but only in developmental stages but have similar capabilities as laser fluorosensors; near range.
Forward Looking Infrared Radar (FLIR)	Thermal infrared detection method that measures different heat signatures by evaluating the brightness temperature of the ocean's surface. Brightness temperature is a function of emissivity.	May potentially show the presence/absence of oil; location of oil spill; oil extent; relative thickness.	Can search for ships; day and night monitoring; common method of detection; can detect through light fog; works on oil covered snow/ice.	Nighttime observations can be slightly ambiguous; false positives; unable to detect emulsions in water; needs proper ground truthing.	Airborne platform.

Appendix D: Remote Sensing Sensors and Their Qualitative Assessments (cont'd)

Table 2: Current remote sensing hydrocarbon sensors currently used by resource managers and scientists. Qualitative assessments of their performance is provided.

Hydrocarbon Sensor Type	Measurement	Information Provided	Strengths	Weaknesses	Remarks
Aerial Video and Photography (includes night vision)	Visually detects the presence of oil in the visible electromagnetic spectrum through observations of color change.	Distribution of oil; detects absence/presence of oil; rough thickness estimates based by color scheme.	With night vision goggles can detect during night; easy to use; quick response to assemble and get information; readily available.	Cannot detect oil through cloud cover or fog; some false positives but w/ training can reduce this; limited thickness info as color scheme is a subjective method of determination	Airborne; most common method of detection; relative estimate.
UV/IR Scanner	Measures the material's ability to absorb and radiate energy at the ultraviolet and infrared wavelengths.	Oil extent; location; presence/absence of oil; relative in thickness.	Ability to see very thin when it comes to thickness; can determine different sources of oil; combining both UV/IR methods of detection to negate false positives; day/night observations; easily available; proven; rugged; good under snow.	Weather conditions such as fog or cloud cover; limited thickness; prone to false positives; night observations limited; not a true oil detector; need proper ground truthing; passive system utilizing the sun as the UV source.	Airborne platform.
UV Camera Illuminated	Utilizes a camera equipped with filters that block out parts of the electromagnetic spectrum and proper illumination either visible or UV to record the emissivity of material.	Detects presence/absence of oil.	To help keep the response unit on the oil for proper containment; simple; low-tech; real-time.	Limited field of view as only strong as the searchlight; use in a restricted area not necessarily open ocean; meant only for use on a ship or helicopter.	Ship or helicopter.
Radio microwave Imaging System	Passive imaging sensor that detects the emission of oil at the microwave wavelength in the electromagnetic spectrum.	Detects presence/absence of oil; distribution; thickness; aerial extent; volume.	All weather; day/night observations; passes through clouds; absolute thickness (50µm-3mm); instantaneous information delivered in real-time; very powerful; can calculate oil volume.	Sea state limitations (white caps will give microwave signatures but oil spill will have likely dispersed at that sea state); dedicated aircraft; low spatial resolution; low availability.	Airborne; near range.

APPENDIX D: REMOTE SENSING SENSORS AND THEIR QUALITATIVE ASSESSMENTS (CONT'D)

Table 2: Current remote sensing hydrocarbon sensors currently used by resource managers and scientists. Qualitative assessments of their performance is provided.

Hydrocarbon Sensor Type	Measurement	Information Provided	Strengths	Weaknesses	Remarks
Ground Penetrating Radar (GPR)	Geophysical method that uses radar pulses in the 10 m microwave frequency of the electromagnetic spectrum to image the subsurface.	Detect presence/absence of oil; oil extent; possible thickness; location; detects oil under ice.	Possible calculation of oil volume; tested fairly well in Arctic climates.	Requires ground team to operate unit above ice; not an airborne or satellite method yet; helicopter cannot detect under snow; needs proper ground truthing.	Airborne (future technology); towed system on belly of helicopter; near range.
Multispectral Scanning Systems	Passive scanning system that collects emitted radiation over a variety of different wavelengths at several discreet spectral band.	Detects presence/absence of oil; distribution; oil extent; location.	Covers large areas; good resolution; able to discriminate between sheens and thick oil; aircraft can go under clouds.	Difficult data interpretation; have to be able to acquire the imagery; sun angle, cloud cover limitations; potential for false positives; need proper ground truthing; need good visibility.	Airborne and satellite; most commonly used scanning system; optical near and far range.
Hyperspectral Imaging	Passive scanning system that collects emitted radiation over the continuous spectrum, visiable and near infared sample at very high spectral resolution.	Detects presence/absence of oil; distribution; oil extent; location; classification.	Covers large areas; good resolution; able to discriminate between sheens and thick oil; aircraft can go under clouds, potential for submerged oil detecting.	Difficult data interpretation; have to be able to acquire the imagery; sun angle, cloud cover limitations; potential for false positives; need proper ground truthing; need good visibility.	Airborne platform; still in the research and development stage; satellite resolution too coarse.
High Frequency (HF) Radar/Coastal Dynamics Radar (CODAR)	Measures wave state and surface current velocity fields near the coast by analyzing the doppler of reflected radio waves.	May potentially detect the presence/absence of oil; possibly movement.	Shore based 24/7 operation; all weather.	Based on theory and adapted for oil spill response; originally intended for the measurement of currents; potential for false positives; need proper ground truthing; need good line of sight; weather limitations; requires multiple base stations.	Commercially available is potential issue.
Nuclear Magnetic Resonance (NMR)	Rather than exciting electrons of particles into a higher energy state as in other hydrocarbon techniques, NMR excites the nucleus in its magnetic field using electromagnetic radiation .	Detect presence/absence of oil; possible thickness; classification.	Potentially good detection method under snow/ice.	Laboratory based unit; not portable but has the potential to become a remote sensing device.	Future applications for hydrocarbon sensing; In experimental testing phase of development.

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Short and Long Term Toxicity of Crude Oil and Oil Dispersants to Two Representative Coral Species

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Oil dispersants, the tool of choice for treating oil spills in tropical marine environments, is potentially harmful to marine life, including reef corals. In a previous study, we found that dispersed oil and oil dispersants are harmful to soft and hard coral species at early life stages. In this broader study, we employed a "nubbin assay" on more than 10 000 coral fragments to evaluate the short- and long-term impacts of dispersed oil fractions (DOFs) from six commercial dispersants, the dispersants and water-soluble-fractions (WSFs) of Egyptian crude oil, on two Indo Pacific branching coral species, *Stylophora pistillata* and *Pocillopora damicornis.* Survivorship and growth of nubbins were recorded for up to 50 days following a single, short (24 h) exposure to toxicants in various concentrations. Manufacturer-recommended dispersant concentrations proved to be highly toxic and resulted in mortality for all nubbins. The dispersed oil and the dispersants were significantly more toxic than crude oil WSFs. As corals are particularly susceptible to oil detergents and dispersed oil, the results of these assays rules out the use of any oil dispersant in coral reefs and in their vicinity. The ecotoxicological impacts of the various dispersants on the corals could be rated on a scale from the least to the most harmful agent, as follows: Slickgone > Petrotech > Inipol = Biorieco > Emulgal > Dispolen.

Introduction

It is estimated that 40% of global crude oil transport is conducted offshore with much of the traffic, taking place in tropical, coral reef-rich areas (*1*, *2*). This heavy maritime traffic of crude oils and their products is prone to accidents, resulting in major or minor spillages. Although the number of major oil spills has decreased in the past decade it is still, by far, the most serious threat to the marine environment (*3*, *4*). Of the three major ways for treating marine oil spills (chemicals, mechanical containment booms, skimmers and sorbents, biological–biodegrading microorganisms), chemicals, mainly oil dispersants (*5*), are probably the most commonly used. Dispersants are chemicals that contain surfactants and/or solvent compounds that break down floating oil into small droplets within the water-column, which makes the spill less likely to reach shore (*6*). Dispersed oil is subjected to natural forces such as waves and currents that promote dissolution of oil droplets. Use of dispersants for treating oil spills is governed by local and national regulations determining, for instance, distance from shore and depth at which treatment is allowed (*7*). However, since most oil-tanker accidents occur near the shore, it is essential to evaluate the impacts of oil dispersants on organisms that live on the seabed (*8*), including sea grass populations and coral reefs.

Most information on ecotoxicological impacts of dispersants comes from studies on North American dispersants of the Corexit family (*9*). Information on other dispersants (e.g., European manufactured dispersants) is limited and their effects on corals is deficient (*4*).

Recent studies on possible toxicity of "environmentally improved" third generation oil dispersants revealed that even these improved chemicals could harm marine biota, in general, and reef corals, in particular. For example, Negri and Heyward (*1*) found that oil-dispersed Corexit 9527 inhibits fertilization of mature eggs and the metamorphosis of *Acropora millepora* larvae. Harmful effects of improved chemicals were also reported by Epstein et al. (*10*) in their study on impacts of five-third-generation dispersants (Inipol IP-90, Petrotech PTI-25, Bioreico R-93, Biosolve and Emulgal C-100) on planula larvae of a stony coral (*Stylophora pistillata*) and a soft coral (*Heteroxenia fuscesense*). The last-mentioned authors found that, compared to the toxicity of dissolved oil fractions, dispersed oil causes a dramatic increase in toxicity to larvae of both species.

In this study, we employed the nubbin bioassay (*11*) to examine the effect of dispersants, oil, and dispersed oil on mature coral colonies of two branching scleractinian corals. We examined the long-term impacts (for up to 50 days) after a single, short (24 h) administration of toxicant.

Materials and Methods

Colonies of *Stylophora pistillata* and *Pocillopora damicornis* were collected from shallow waters (4–6 m depth) in Eilat, Red Sea, and transported, immersed in seawater within insulated containers, to the National Institute of Oceanography, Haifa where they were maintained under conditions previously described in ref *12*. To include a wide species-variability, each set of assays was performed on nubbins taken from three different genotypes per species (all nubbins from a single colony were genetically identical, an outcome that reduces variation within and among tests).

Nubbins (average surface area 31.1 ± 9.7 mm^2, approximately 5–10 polyps each) were pruned from coral colonies using an electrician's wire-cutter and immediately immersed in seawater to minimize stress. The exposed skeletal surfaces of the freshly cut nubbins were dried with paper towels and glued with a drop of cyanoacrylate glue (Super Glue 3, Loctite, Ireland) onto dry glass slides, five nubbins per glass (*13*).

A stock solution of water-soluble fractions (WSFs; 10) from Egyptian crude oil was prepared by adding 5 mL of crude oil to 995 mL of filtered seawater (1:200 ratio). Then, the mixture was shaken for 24 h at 80 rpm after which only the soluble fraction was collected in a separating funnel. The dispersed oil fractions (DOF) stock solution was prepared according to the manufacturer's recommendations, usually 1:10 dispersant:oil volume ratio. For this purpose, we added 0.5 mL of the tested dispersant to the crude-oil–seawater mixture and followed the above preparation methodology. The dispersant stock solution was prepared by adding 0.5 mL of the tested dispersant (1:2000 ratio) to 995.5 mL of filtered seawater.

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TABLE 1. Average Survivorship of *S. Pistillata* and *P. Damicornis* Nubbins One Week after Administration (24 h) of Nine Graded Solutions of Crude Oil WSP and Dispersed Oil Fractions (DOF)

species	treatment	*N*	100%	75%	50%	25%	10%	5%	1%	0.5%	0%
S. pistillata	Egyptian WSF	540	92% ± 4%	92% ± 4%	94% ± 3%	95% ± 3%	98% ± 2%	93% ± 4%	93% ± 4%	100%	100%
	DOF Biorieco	540	0%	0%	0%	0%	96% ± 0%	100%	96% ± 3%	100%	100%
	DOF Dispolen	540	0%	0%	0%	0%	0%	98% ± 6%	98% ± 7%	98% ± 6%	98% ± 6%
	DOF Emulgal	540	0%	0%	0%	0%	93% ± 4%	91% ± %	100%	99% ± 1%	96% ± 3%
	DOF Inipol	540	0%	0%	0%	0%	65% ± 57%	100%	99% ± 2%	100%	100%
	DOF Petrotech	540	0%	0%	0%	0%	85% ± 3%	80% ± 28%	97% ± 6%	95% ± 5%	92% ± 11%
	DOF Slickgone	540	0%	0%	0%	88% ± 12%	98% ± 3%	100%	100%	100%	97% ± 6%
P. damicornis	Egyptian WSF	540	74% ± 13%	72% ± 5%	71% ± 9%	68% ± 3%	60% ± 52%	73% ± 16%	78% ± 8%	71% ± 12%	85% ± 5%
	DOF Biorieco	540	0%	0%	0%	0%	38% ± 48%	96% ± 7%	100%	97% ± 5%	97% ± 5%
	DOF Dispolen	540	0%	0%	0%	0%	0%	98% ± 2%	98% ± 2%	97% ± 6%	100%
	DOF Emulgal	540	0%	0%	0%	0%	29% ± 27%	95% ± 6%	93% ± 6%	92% ± 11%	95% ± 6%
	DOF Inipol	540	0%	0%	0%	0%	35% ± 28%	60% ± 8%	67% ± 10%	85% ± 5%	83% ± 7%
	DOF Petrotech	540	0%	0%	0%	0%	98% ± 3%	95% ± 9%	92% ± 6%	93% ± 3%	98% ± 3%
	DOF Slickgone	540	0%	0%	0%	97% ± 2%	92% ± 11%	100%	100%	100%	93% ± 6%

TABLE 2. Average Survivorship of *S. Pistillata* Nubbins, One Week after Administration (24 h) of Nine Graded Solutions from Each Tested Dispersant

dispersant	N	100%	75%	50%	25%	10%	5%	1%	0.5%	0%
Biorieco	540	0%	0%	0%	0%	3% 6%	98% ± 3%	100%	98% ± 3%	100%
Dispolen	540	0%	0%	0%	0%	0%	92% ± 14%	93% ± 3%	98% ± 3%	98% ± 3%
Emulgal	540	0%	0%	0%	0%	2% ± 3%	73% ± 26%	100%	97% ± 2%	94% ± 5%
Inipol	540	0%	0%	0%	0%	73% ± 28%	100%	98% ± 3%	100%	98% ± 3%
Petrotech	540	0%	0%	0%	0%	83% ± 23%	71% ± 39%	80% ± 29%	64% ± 37%	79% ± 33%
Slickgone	540	0%	0%	0%	0%	82% ± 28%	100%	97% ± 3%	98% ± 3%	100%

Six dispersants were tested: Emulgal C-100 (Amgal Chemicals, Israel), Dispolen 36S (SEPPIC), Inipol 90 (CECA S.A. France), Petrotech PTI-25 (Petrotech Emergency), Slickgone NS (Dasic Int. Ltd. UK), Bioreico R-93 (Reico France). The dispersants stock solutions were considered to be at 100% concentration. In the experiment with crude oil WSFs, nubbins were introduced into seawater with six different concentrations of crude oil WSF: 100, 75, 50, 25, 10, and as a control, 0% as control. Nine concentrations were tested in both the dispersants and DOFs experiments: 100, 75, 50, 25, 10, 5, 1, 0.5, and as a control, 0%.

The above assays were performed on short- (7 days) and long-term (50 days) acute responses to oil WSFs and dispersed oil fractions. The dispersants' impacts were tested only in short-term assays. In each experiment, 60 nubbins (20 from each genotype; 10 800 nubbins total) were subjected during a 24 h period to different toxicant concentrations. The nubbins were then washed carefully for several minutes under freshly filtered seawater and placed in new aquaria supplied with flowing filtered seawater. Survivorship was monitored daily during the first week of the experiment, and it was then monitored weekly. Horizontal tissue growth on the glass slide was evaluated weekly.

For grading the relative toxicity of the tested dispersants to corals, the results (see below) of each experiment (a) were divided by the control values of that experiment (b) and then multiplied by the concentration of the administrated toxicant (DOF, WSF, dispersant; c). The sum value (e) of all treatments of each dispersant ($e = \Sigma(a/b)xc$) was divided by the value of the most toxic dispersant in that experiment (f), providing a grade (g) for dispersant toxicity ($g = e/f$). Average quality of dispersant toxicity (q) was calculated from both coral species (*Stylophora*, *Pocillopora*). The relative toxicity (RT) of a specific dispersant was established as the average values from the survivorship after 7 days (q, 7), survivorship after 50 days (q, 50), and percentages of nubbins that developed horizontal tissues on the substrates (q, tissue), combining short- and long-term toxicity results.

Results

Two timeframes (short and extended post treatment period) assays were applied to evaluate various ecotoxicological impacts that developed following 24 h exposure to toxicants. The short time assays examined the survivorship of the nubbins up to a week after exposure to various WSF and DOF concentrations. Most results (dead vs alive) were detectable as early as the end of the 24 h treatments, but in several treatments, dead tissue lingered on the coral skeleton for a few more days, making it difficult to determine the status of the nubbins. Therefore, the endpoint of the short-term experiments was confirmed within 7 days after adminstering the toxicant.

None of the crude oil WSF concentrations had any impact on the survivorship of either *Stylophora pistillata* or *Pocillopora damicornis* nubbins ($p > 0.05$ ANOVA one-way; Table 1). However, all 100% (stock solution) dispersed oil DOFs (the recommended concentrations by the manufacturers, 1:10), as well as the 75 and 50% (1:20) concentrations of all dispersant−oil combinations, the 25% concentrations of all dispersant−oil combinations (except Slickgone), and the Dispolen DOF 10% concentration, caused 100% mortality to nubbins of both coral species. Bioreico, Emulgal and Inipol 10% DWSPs showed significant mortality only in *P. damicornis* nubbins with 38, 29, and 35% survivorship respectively, compared to 97, 95, and 83% of the controls ($p < 0.05$ *t* test; Table 1).

A control experiment on the affect of dispersants alone was preformed on *Stylophora pistillata* nubbins. As with the DOF solutions, all 100% (stock solution; 0.05%) of the dispersants, as well as 75, 50, and 25% concentrations of all dispersant solutions resulted in 100% nubbins mortality. Furthermore, Dispolen 10% concentration caused 100% mortality to the nubbins, and Emulgal and Biorieco 10% concentrations caused 98 and 97% mortality, respectively. On the other hand, The results of the Inipol, Slickgone, and Petrotech 10% concentrations showed high survivorship rates (73, 82, and 83%, respectively; Table 2).

In the expanded experiments, nubbins were maricultured for 50 days following acute exposure to the WSFs and DOFs concentrations. Within this period, the cultured nubbins did not show any delayed mortality effects (Table 3). Most nubbins that had survived the first week continued to live. Three weeks after toxicant administrations, nubbins attached onto glass slides started to grow flat horizontal tissues and

TABLE 3. Average Survivorship of *S. Pistillata* and *P. Damicornis* Nubbins 50 days after Administration (24 h) of Nine Graded Solutions of Crude Oil WSP and Dispersed Oil Fractions (DOF)

species	treatments	N	100%	75%	50%	25%	10%	5%	1%	0.5%	0%
S. pistillata	Egyptian WSF	540	76% ± 30%	82% ± 15%	77% ± 27%	75% ± 5%	73% ± 5%	78% ± 14%	80% ± 11%	76% ± 15%	83% ± 8%
	DOF Biorieco	540	0%	0%	0%	0%	92% ± 11%	67% ± 36%	77% ± 36%	99% ± 2%	89% ± 10%
	DOF Dispolen	540	0%	0%	0%	0%	0%	87% ± 20%	85% ± 21%	82% ± 22%	82% ± 23%
	DOF Emulgal	540	0%	0%	0%	0%	91% ± 6%	90% ± 9%	98% ± 3%	97% ± 5%	96% ± 2%
	DOF Inipol	540	0%	0%	0%	0%	59% ± 51%	96% ± 4%	96% ± 4%	99% ± 2%	88% ± 7%
	DOF Petrotech	540	0%	0%	0%	0%	53% ± 20%	53% ± 45%	34% ± 27%	43% ± 42%	31% ± 28%
	DOF Slickgone	540	0%	0%	0%	83% ± 11%	88% ± 20%	98% ± 8%	88% ± 18%	86% ± 25%	83% ± 19%
P. damicornis	Egyptian WSF	540	41% ± 41%	23% ± 24%	36% ± 36%	31% ± 24%	46% ± 40%	43% ± 38%	47% ± 41%	45% ± 37%	48% ± 44%
	DOF Biorieco	540	0%	0%	0%	0%	25% ± 40%	67% ± 41%	81% ± 20%	67% ± 16%	66% ± 12%
	DOF Dispolen	540	0%	0%	0%	0%	0%	58% ± 23%	87% ± 8%	90% ± 13%	82% ± 15%
	DOF Emulgal	540	0%	0%	0%	0%	13% ± 12%	57% ± 14%	63% ± 33%	63% ± 33%	63% ± 27%
	DOF Inipol	540	0%	0%	0%	0%	21% ± 26%	26% ± 24%	21% ± 18%	54% ± 11%	62% ± 3%
	DOF Petrotech	540	0%	0%	0%	0%	88% ± 8%	88% ± 13%	88% ± 8%	90% ± 5%	83% ± 8%
	DOF Slickgone	540	0%	0%	0%	80% ± 16%	68% ± 7%	92% ± 11%	90% ± 6%	93% ± 8%	70% ± 14%

TABLE 4. Percentages of Nubbins (of Total Surviving) That Developed, after 50 Days, Horizontal Tissue on the Substrate (NA, Not Available, All Nubbins Died)

		toxicant concentration					
species	treatments	N	10%	5%	1%	0.5%	0%
S. pistillata	Egyptian WSF	420	98% ± 2%	93% ± 4%	93% ± 4%	100%	100%
	DOF Biorieco	250	11% ± 11%	38% ± 14%	58% ± 19%	71% ± 36%	64% ± 15%
	DOF Dispolen	200	NA	49% ± 40%	47% ± 45%	53% ± 32%	45% ± 41%
	DOF Emulgal	300	77% ± 22%	73% ± 4%	66% ± 15%	64% ± 18%	91% ± 10%
	DOF Inipol	260	26% ± 23%	64% ± 18%	76% ± 3%	81% ± 10%	77% ± 7%
	DOF Petrotech	130	91% ± 4%	51% ± 21%	48% ± 17%	25% ± 11%	59% ± 34%
	DOF Slickgone	320	59% ± 13%	63% ± 18%	65% ± 18%	80% ± 17%	60% ± 29%
P. damicornis	Egyptian WSF	220	65% ± 24%	77% ± 12%	70% ± 9%	85% ± 11%	89% ± 8%
	DOF Biorieco	190	36% ± 11%	80% ± 17%	77% ± 16%	89% ± 8%	54% ± 21%
	DOF Dispolen	190	NA	88% ± 14%	90% ± 8%	91% ± 10%	94% ± 4%
	DOF Emulgal	160	0%	13% ± 26%	31% ± 18%	98% ± 3%	82% ± 17%
	DOF Inipol	190	5% ± 11%	42% ± 48%	39% ± 49%	38% ± 33%	23% ± 25%
	DOF Petrotech	260	39% ± 34%	73% ± 11%	59% ± 24%	76% ± 15%	76% ± 18%
	DOF Slickgone	300	64% ± 21%	70% ± 17%	69% ± 11%	85% ± 7%	88% ± 9%

skeletons on the slides as recorded earlier (*11*). Nubbins that started to spread on substrates were monitored and photographed digitally, as described in ref *11*. After 50 days, most surviving nubbins grew horizontal tissues but some showed delayed effects in two parameters: percentage of nubbins that developed horizontal tissue and onset for initial tissue growth.

None of the crude oil WSFs had any impact on lateral growth of either *Stylophora pistillata* or *Pocillopora damicornis* nubbins ($p > 0.05$, one-way ANOVA; Table 4). Since *S. pistillata* and *P. damicornis* nubbins exposed to 10% Dipolen WSF solution had not survived after one week, they were not taken into consideration in the growing long-term assay. However, at least, some of the experiments with dispersant administration revealed significant impacts on lateral growth. *S. pistillata* nubbins exposed to Biorieco and Inipol at 10% DOF concentration exhibited long-term effect of suppressed growth. Under the influence of these materials, only 11 and 26%, respectively, of the surviving nubbins developed horizontal tissues after 50 days from toxin exposure, compared to the 64 and 77%, respectively, of the control ($p < 0.05$ t test; Table 4). *P. damicornis* nubbins exposed to Emulgal 10% DWSP failed to grow horizontal tissues. *P. damicornis* nubbins exposed to Emulgal 5 and 1% DOFs showed suppressed development: 13 and 31%, compared to 82% of the control ($p < 0.05$ t test; Table 4). Furthermore, Biorieco 10 and 5% DOF caused three- and two-week delays in *S. pistillata* nubbins horizontal tissues development. Dispolen 5% DOF caused a one-week delay, and Inipol 10 and 5% DOF caused one- and two-week delays, respectively (Table 5). Biorieco 10%, Dispolen 5%, and Emulgal 5% DOF caused delays to growth of *P. damicornis* nubbins' horizontal tissues by one week, and Inipol 10% DOF caused a two-week delay (Table 5).

TABLE 5. Weeks Delay in Beginning of Horizontal Tissue Growth (NA= Not Available, All Nubbins Died; NT, No Horizontal Growth Developed)

		toxicant concentration				
species	treatments	10%	5%	1%	0.5%	0%
S. pistillata	Egyptian WSF	0	0	0	0	0
	DOF Biorieco	−3	−2	0	0	0
	DOF Dispolen	NA	−1	0	0	0
	DOF Emulgal	0	0	0	0	0
	DOF Inipol	−2	−1	0	0	0
	DOF Petrotech	0	0	0	0	0
	DOF Slickgone	0	0	0	0	0
P. damicornis	Egyptian WSF	0	0	0	0	0
	DOF Biorieco	−1	0	0	0	0
	DOF Dispolen	NA	−1	0	0	0
	DOF Emulgal	NT	−1	0	0	0
	DOF Inipol	−2	0	0	0	0
	DOF Petrotech	0	0	0	0	0
	DOF Silckgone	0	0	0	0	0

Discussion

Oil dispersants play an important role in environmental technologies aiming to enhance the dissolving of oil in the water column by converting oil spills into chemically dispersed droplets. Potential ecotoxicological effects of this change must be taken into consideration because benthic organisms that initially are not affected by oil may be exposed to the harmful impacts of dispersants (*9*, *10*). The fragile coral reefs, and, particularly their building blocks, the scleractinan corals, need extra care when dealing with the devastating agents of oil and oil dispersants.

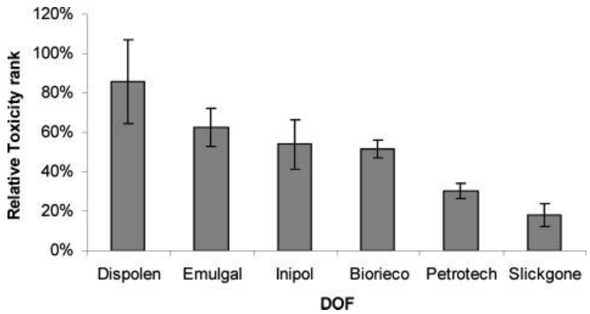

FIGURE 1. Relative toxicity (RT) of the six tested dispersants on corals (calculated form the results presented in Tables 1, 3−5). DOF, dispersed oil fractions.

As reported earlier (*10*), the results of this study have reconfirmed the increased toxicity of dispersed oil when compared to untreated oil (but there is no synergistic detrimental impacts from the dispersant and oil together). Even when dealing with improved formulas, often described as environmentally friendly dispersants (*4*), the high toxicity effects of all six approved−to-use oil dispersants on corals, strengthen the general recommendation to ban oil dispersants from the vicinity of coral reefs, if possible (when the oil slick is not stranded on the reef flat). Earlier (*10*), we found that both dispersed oil and oil dispersants are harmful to early stages of soft and hard coral species by reducing settlement and survivorship rates and by altering morphology and behavior of planulae and spats. Dispersed oil revealed synergistic detrimental impacts (*10*). In the present study, we gained knowledge on ecotoxicological impacts to corals by employing the nubbin assay (*11*), on thousands of coral fragments taken from two coral branching species. Evaluating the ecotoxicological impacts on coral nubbins during short and long periods (up to 50 days after toxicant administration), allowed us to observe the effects on the whole organism by monitoring survivorship and the physiological parameter of tissue growth on the substrate.

The results of the six dispersants examined here have revealed that the manufacturers recommended usage ratio of 1:10 dispersant:oil inflicts significant harm on coral colonies. Epstein et al.(10) rated the dispersants they tested, from the least to the most toxic compound, as follows: Petrotech < Bio-solve < Emulgal < Bioreico = Inipol. By consolidating the parameters tested in the present study on both coral species into one common scale, the relative toxicity (RT) value, we found that out of the six tested dispersants, Slickgone is the least toxic dispersant to corals and Dispolen is the most toxic (Figure 1). Rating the RT values of the tested dispersants resulted in the following order: Slickgone < Petrotech < Inipol = Biorieco < Emulgal < Dispolen (Figure 1). It is interesting to note that the four dispersants employed here and by Epstein et al. (*10*) were ranked, in both experiments, by the same toxicity hierarchy (Petrotech < Inipol = Biorieco < Emulgal). Of the two new oil dispersants used here, one (Slickgone) emerged as the least toxic to corals, whereas the second (Dispolen) was found to be the most toxic to corals.

In conclusion, corals are particularly susceptible to oil detergents and dispersed oil. Consequently, decision-making authorities should carefully consider these results when evaluating possible use of oil dispersants as a mitigation tool against oil pollution near coral reef areas. The results of the present and earlier studies (*10*, *11*) imply that the use of any oil dispersant in coral reefs and its vicinity should be avoided. Chemical dispersants should be considered only in emergencies, when oil slicks are shore-bound and threatens to smother the reef flats.

Acknowledgments

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Literature Cited

(1) Negri, A. P.; Heyward, A. J. Inhibition of fertilization and larval metamorphosis of the coral *Acropora millepora* (Ehrenberg, 1834) by petroleum products oil contamination along oil tanker routes off the United Arab Emirates (The Arabian Gulf and the Gulf of Oman). *Mar. Pollut. Bull.* **2000**, *7*, 420−427.

(2) Prince, R. C.; Lessard, R. R.; Clark, J. R. Bioremediation of marine oil spills. *Oil Gas Sci. Technol.* **2003**, *58*, 463−468.

(3) Heubeck, M.; Camphuysen, K. C. J.; Bao, R.; Humple, D.; Sandoval Rey, A. S.; Cadiou, B.; Brager, S.; Thomas, T. Assessing the impact of major oil spills on seabird populations. *Mar. Pollut. Bull.* **2003**, *46*, 900−902.

(4) NAS. *Oil Spill Dispersants: Efficacy and Effects*; National Academy of Sciences: Washington, DC, 2005.

(5) Walker, A. H.; Kucklick, J. H.; Michel, J. Effectiveness and environmental considerations for non-dispersant chemical countermeasures. *Pure Appl. Chem.* **1999**, *17*, 67−81.

(6) Fiocco, R. J.; Lewis, A. Oil spill dispersants. *Pure Appl. Chem.* **1999**, *71*, 27−42.

(7) Mearns, A.; Watauayashi, G.; Lankford, J. Dispersing oil near shore in the California current region. *CalCOFl Rep.* **2001**, *42*.

(8) McMahon, A. C.; Labelle, R. P. Update of comparative occurrence rates for offshore oil spills. *Spill Sci. Technol. Bull.* **2000**, *6*, 303−321.

(9) Singer, M. M.; George, S.; Jacobson, S.; Lee, I.; Weetman, L. L.; Tjeerdema, R. S.; Sowby, M. L. Comparison of acute aquatic effects of the oil dispersant Corexit 9500 with those of other Corexit series dispersants. *Ecotoxicol. Environ. Safety* **1996**, *35*, 183−189.

(10) Epstein, N.; Bak, R. P. M.; Rinkevich, B. Toxicity of 3rd generation dispersants and dispersed Egyptian crude oil on Red Sea coral larvae. *Mar. Pollut. Bull.* **2000**, *40*, 497−503.

(11) Shafir, S.; Van-Rijn, J.; Rinkevich, B. The use of coral nubbins in coral reef ecotoxicology testing *Biomol. Eng.* **2003**, *20*, 401−406.

(12) Shafir, S.; Van-Rijn, J.; Rinkevich, B. Nubbins of coral colonies: A novel approach for the development of inland broodstocks. *Aquarium Sci. Conserv.* **2001**, *3*, 183−190.

(13) Shafir, S.; Van Rijn, J.; Rinkevich, B. Coral nubbins as source material for coral biological research: a prospectus. *Aquaculture* **2006**, *259*, 444−448.

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ES0704582

Canadian Smart Team Update to Smart Team Coordinator

May 9

Searched for oil at location 29 40 17 / 088 54 34 but none was found. Spotter plane provided possible oil location at 1 pm but we had already confirmed no oil at this location.

Deployed LISST in data logger mode over side of Grand Bay. Data was collected in heavily sediment laden water near channel entrance to test the system in data logger mode.

AST Smart system was booted up. Had password login difficulty. Problem was the num lock key was on and this prevented login with correct password entry. Once booted early comms problems were encountered. Re-boots eventually corrected problems. No oil was encountered so no C3 data was recorded.

The shift -> m key was also not functioning on the AST Smart tough book.

May 10

Possible oil locations were provided by NOAA over flight information. Traveled towards the Chandeleur Islands.

Observed small pieces of emulsion (thumb sizes to palm sized only) surrounded by extensive areas of sheen. Particle coverage was slight and not consistent. Some areas had less than 10 pieces in a 5m x 5m area whiles others contained a few dozen in the same water surface area.

Oil locations:
29 37.852 / 088 57.445
29 40.041 / 088 54.034
29 10.600 / 089 00.205

Photos of oil below.


Thumb-sized pieces of emulsion


This was one of the higher concentrations of emulsion pieces encountered.

Sheen from emulsion bits.

Instruments powered up and tested.

LISST system was deployed in data logger over side of vessel. Determined that we needed to hold the LISST out from vessel side with outrigger.

The AST Smart system encountered problems with communications in Terminal Mode. Multiple system re-boots did not solve the problem. Back-up plan was to log C3 data separately through standard C3 software, log positioning through GPS software and merge data after capture. No oil was encountered so no C3 data was recorded.

May 11

Grand Bay broke a shaft while just exiting the dock. This was fortunate timing for us as we able to transfer equipment to the RW Armstrong and still carry out the day's activities.

Searched for oil at 29 / 089. Oil was not found at this location but large mats of floating seaweed with a very similar color to the emulsified oil were. A false positive sight of oil had obviously been recorded. Recommend passing on to spotter personnel that if large areas of sheen are not seen with apparent heavy patches of oil that ground-truthing or a closer look be taken to ensure a positive sighting.

Photos of seaweed below:

No oil was encountered on this day as closest oil found by spotter aircraft was out of our range for the day.

LISST system was deployed in data logger mode from outrigger. Transit speed must be about 1 knot or less to prevent LISST form planning in water.

AST smart system powered up and functioned properly without the problems that we had encountered on earlier days.

May 12

Traveled on a trajectory direct to the spill site from South Pass. Oil was expected to be present about 32 miles from South Pass exit based on previous days trajectory modeling but was not found until about 5 miles from the spill site. A consistent rainbow sheen was encountered about 3 miles from the spill site at 28 45.282 / 088 24.649. As we approached the spill site significant quantities of ‘rag’ emulsion was seen in the water mixed in the upper meter or so by wave action.

Rag emulsion in upper water layer near spill site.

Once the spill site was reached a stretch of thick oil between the many vessels operating in the area was selected for the dispersant tests and spraying was started. All spray nozzles clogged on first spray attempt. Nozzles were removed and cleared.

JD 2000 was used in first spray run. It was sprayed with a vessel speed of approximately 2 knots for a total of 21 min 50 sec. Sprayed for 10 min between 28 44.460 / 088 21.963 and 28 44.256 / 088 21.632 vessel turned and sprayed back to start position parallel to initial pass. Inner port side nozzle clogged shortly into spray run and two other nozzles (one on starboard and one on port) were partially blocked. Some café au lait dispersion evident but dispersion did not seem as dramatic as previous Sea Brat test (Tom Coolbaugh's obs.)

Photos of JD 2000 test follow.

JD 2000 Application Starboard Side

JD2000 Early Dispersant Effect

LISST was deployed in real time mode so oil drop size distribution could be monitored during sampling. After 300 data points were captured (645 seconds or about 10 minutes of data) the communications link to the LISST failed and data capture was lost. There was no evidence of small drop dispersion in the recorded data but this data only covered a small portion of the instrumentation run.

The C3 was successfully deployed and data was captured as transects were conducted tracking back and forth across the path of dispersant application. Elevated oil readings were obtained but these might be misleading as there was a considerable amount of rag emulsion submerged below the surface throughout the test area that could be the cause of elevated readings rather than the presence of dispersed oil.

By the time we were finished the instrument run for the JD 2000 spray test time was not available to complete a full test of another dispersant. A quick spray with Dispersit SPC 1000 was conducted and only visual observations of its effectiveness were made. Dispersant was sprayed from one side of the RW Armstrong as a nozzle was lost from the port spray arm and time was not available to effect the repair.

The Dispersit SPC 1000 application was completed in a zone of relatively thin oil so visuals were not optimal. There was evidence of small drop dispersion (café au lait) during the application. We did not return to observe any long term effect.

Photos of Dispersit SPC 1000 follow.

Dispersit SPC 1000 Early Dispersant Effect

If time and priorities permit additional testing of both of these dispersants on the fresh oil is recommended so quantitative data (oil drop size and oil fluorescence) can be collected to validate visual observations.

Having said this it appears that both dispersants tested on this day exhibited some level of effectiveness on the fresh crude oil.

Of the three tested on fresh oil to date, Sea Brat appeared to be the most effective followed by Dispersit SPC 1000 and JD 2000. This is supported primarily by visual observation only as adequate in-water data has yet to be collected.

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Aquatic Living Resources

Human-induced physical disturbances and their indicators on coral reef habitats: A multi-scale approach

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Abstract – This article aims to review 1) the major and most frequent human-induced physical disturbances and their consequences on coral reef habitats using a multi-scale approach, and 2) the scale-related indicators and conceptual aspects used to detect and measure the effects of these physical impacts. By physical disturbances, we mean direct perturbations that lead to the destruction/erosion of the carbonate framework. Human-induced direct physical disturbances are numerous from coastal development, tourism, harvesting, accidents and nuclear/weapon testing. Since methods for monitoring and measuring indicators are generally scale-implicit, coral reefs are first presented according to different ecological-spatial scales of organization, from colony to region (colony, reefscape, reef zone, whole reef, island and region). In this way, it is easier to link a couple {habitat, disturbance} to their potential indicators and to the descriptors they target. Three classes of descriptors, related to the response of the living component of coral reef ecosystem, are considered here: stony coral, reef fishes and the human uses. A synthesis of the different options for coral habitat assessments is proposed. We sort them according to their objectives (monitor, initial status or improvement of knowledge), their specificities (identification or not of a specific disturbances) and their scale of investigation (small, meso- or large scales). Usually, the majority of the indicators of human-induced disturbances are non-specific. They reveal that something is happening but not the actual causality and can only detect differences across time or space. A major weakness lies in the difficulty in deconvoluting the signals from a conjunction of stressors occurring at different scales. As such, a hierarchical concept of disturbances in coral reefs would be the next logical step to enhance our capabilities in monitoring and forecasting coral reefs status.

Key words: Coral reef / Physical disturbances / Habitat / Human-induced disturbances / Indicator

Résumé – Indicateurs des perturbations physiques et anthropiques de l'habitat corallien : une approche multi spatiale. Cet article a pour but d'examiner à travers une approche multi-spatiale 1) les principales et les plus fréquentes perturbations physiques sur l'habitat corallien et leurs conséquences, 2) les indicateurs de ces perturbations et les aspects conceptuels utilisés pour détecter et mesurer les effets de ces impacts. Seules, les dégradations physiques ayant un impact direct sur la destruction et l'érosion de la trame carbonatée du récif corallien sont considérées. Ce type d'impact, fréquent en milieu corallien, peut être généré par l'urbanisation du littoral, les activités touristiques (plongée sous-marine), la récolte d'organismes (piétinement, pêche à la dynamite), les essais nucléaires ou des accidents (échouage de navires). Les méthodes d'échantillonnage et les indicateurs utilisés pour le suivi des récifs étant reliés à l'échelle d'observation, les récifs coralliens sont abordés dans un premier temps en fonction de ces différentes échelles spatiales (colonie, paysage, partie du récif, récif en entier, île, région). De cette manière, il est plus facile de relier le tandem {habitat, perturbation} aux potentiels indicateurs et descripteurs ciblés. Trois classes de descripteurs reliées à la composante vivante de l'écosystème récifal sont considérées : les coraux constructeurs de récif, les poissons récifaux (Chaetodontidae) et l'homme à travers l'utilisation qu'il fait de l'écosystème. Une synthèse des différentes options pour évaluer l'état du récif corallien est proposée. Elles ont été sélectionnées en fonction des objectifs (suivi, état initial ou amélioration des connaissances), de leurs spécificités (identificateur ou non de la perturbation) et l'échelle d'investigation (petite, moyenne ou large). La majorité des indicateurs d'une perturbation anthropique n'est pas spécifique à un type de perturbation. Ils révèlent que quelque chose s'est passé, mais pas spécifiquement la cause actuelle de la perturbation ; ils ne peuvent donc que détecter des différences au cours du temps ou de l'espace. Un des obstacles pour détecter spécifiquement une perturbation réside dans la difficulté de dissocier les signaux d'un ensemble de stress qui se répercutent à différentes échelles spatiales. Ainsi, une approche conceptuelle hiérarchique de perturbations en milieu corallien serait la prochaine étape à franchir pour améliorer nos connaissances afin de mieux suivre l'état des récifs coralliens et anticiper leurs dégradations.

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1 Introduction

Coral reefs are characterized by their high species diversity and high gross productivity, among the highest of Earth's marine or terrestrial ecosystems (Connell 1978; Ray 1988). Coral reefs, frequently associated with seagrass beds and mangrove forests on tropical shorelines, supply vast numbers of people with goods and services such as seafood, recreational possibilities, and coastal protection providing significant aesthetic, cultural and economical benefits for many tropical countries (Done et al. 1996; Constanza et al. 1997; Berg et al. 1998).

Scleractinians (stony corals) are the main contributor of the reef framework since coral polyps secrete a carbonate skeleton at an average of 5 kg calcium carbonate per square meter (Kinsey 1985). The high calcification rates of these organisms are possible due to a symbiotic association with microscopic unicellular algae, the zooxanthellae that facilitate the growth and secretion of the calcium carbonate skeleton (Goreau 1959; Smith 1985; Gattuso et al. 1993, 1999). Crustose coralline algae, foraminifera and molluscs may also contribute significantly to the carbonate budget of a reef, which itself results from the accretion of the carbonate material at a geological scale. However, various agents balance continuously the calcification process through chemical, physical or biological erosion. As a result of a variety of environmental forcing and the duality between coral growth and carbonate dissolution/destruction, reefs provide a variety of three-dimensional complex habitats and niches for a variety of fish, molluscs, crustaceans and other reef-dwelling animals. The diversity of niches and habitats partially explain the diversity and structure of living community that exist on many coral reefs worldwide (Veron 1986; Done 1992).

Usually, ecologists consider as disturbances the factors that prevent calcification or enhance destruction/erosion of the carbonate framework. These disturbances play an important role in shaping continuously coral reef communities and their architecture (Connell 1978; Grigg 1983; Brown and Howard 1985; Hughes 1989; Grigg and Dollar 1990; Done 1992; Connell et al. 1997; Hughes and Connell 1999). Disturbances can be natural (e.g., ingestion by parrotfish of large amounts of coral rock, Bruggeman 1994; Peyrot-Claussade et al. 1995; sponges and echinoids grazing, Hutchings 1986) or induced by human activities.

Man-induced physical disturbances are numerous, including over-harvesting of reef organisms (Grigg 1984; Wells and Alcala 1987), coral mining (White 1987; Brown and Dunne 1988), destructive fishing methods (Carpenter and Alcala 1977; Alcala and Gomezn 1987; Gomez et al. 1987; McManus et al. 1997; Salvat et al. 2002; Erdmann 2000; Jackson et al. 2001; Fox et al. 2005) or uncontrolled land reclamation for tourism and coastal development (Tilmant 1987; Allison 1996; Hawkins and Roberts 1997; Guzman et al. 2003). The effects of these disturbances can be detected at different scales. These disturbances have direct consequences on stony corals ranging from colony to reef zone. With the expansion of human population on coastlines, and deforestation or intensive agriculture on the upstream watersheds, the increase in nutrient delivery (Marszaleck 1981a; Bell 1992; Naim et al. 2000), sediment and pollutant loads (Pastorok and Bilyard 1985) can have significant consequences at whole reef scale or even regional scale. Finally, activities occurring very far from the reefs may have consequences at a global scale. Indeed, greenhouse warming and global change are the usual suspects to explain more frequent occurrences of coral bleaching events, and may potentially increase hurricane frequencies and strengths (Knutson et al. 1998; Hoegh-Guldberg 1999; Kleypas et al. 2001). Human impacts and increased fragmentation of coral reef habitat have undermined reef resilience, making them much more susceptible to current and future climate change (Hughes et al. 2003). Being able to specifically identify the consequences of human actions on reef communities would be a valuable tool in terms of management. Unfortunately, it is not always easy to find the right key, or indicator, that will decode without ambiguity the signal of a human-induced stress on coral reefs.

This article aims to review:

- the major and most frequent human-induced physical disturbances and their consequences on coral reef habitats considering different levels of ecological organisation associated with various spatial scales (colony scale to region scale), and
- the scale-related indicators and conceptual aspects to detect and to measure the effects of these physical disturbances. By physical disturbances, we mean all events that lead to destruction/erosion of the carbonate framework of a colony, community or entire reef.

Within the limit of this article, we do not consider either man-induced non-physical disturbances such as chemical pollution, eutrophication, or thermal stress, nor non-human, natural, physical-perturbations, such as hurricanes, coral-bleaching events, or outbreaks of predators. Furthermore we will not address indirect perturbations such as global human induced greenhouse warming. Only direct perturbations will be specifically identified here.

2 Multi-scale habitat in coral reef environments

The habitat of an organism can be intuitively defined as the place where it lives, and which provides food, shelter and living space to the organism. More formally, a habitat can be defined as a spatially-bounded area, with a subset of physical and biotic conditions, within which the density of interacting individuals, and at least one of the parameters of population growth, is different than in adjacent subsets (Morris 2003). Then, habitat must be defined by the species and populations of interest, and in a manner that reflects underlying processes operating at appropriate spatial and temporal scales. Coral habitats can be classified according to an ecological function (e.g., nursery grounds) and/or according to a spatial or structural pattern (e.g., the distribution of living and non-living components). These approaches are not mutually exclusive, since function and structure are intimately linked at all levels of biological organization. A particular organism can occupy different habitats at different stages of its life and according to its activity (growth, foraging, sheltering and reproduction). This vision is compatible with a hierarchical, multi-scale presentation of reef habitats. For example, a colony is a habitat, but

it is also submitted to a specific hydroclimate, which control a region. Since methods for monitoring and measuring indicators are generally scale-implicit, we propose a presentation by ecological-spatial scales (Fig. 1). This presentation makes easier to link directly a couple {habitat, disturbance} with its potential indicators (Sect. 4). Such a hierarchical decomposition is appropriate for complex systems (O'Neill et al. 1989; O'Neill 2001).

2.1 Level 1: Individual coral colony, community and reefscape

The level of habitat can be referred as a small-scale level: 1 to 10 m spatial unit. It corresponds to what most coral reef ecologists refer to when they use the concept of habitat. Individual coral colonies create a microcosm that offers shelter and food for various species. The success of coral recruitment depends upon a variety of environmental factors (temperature, light, sedimentation, salinity, nutrient regime, wave action and type of substrate). The spatial aggregation of coral colonies within a mono- or multi-specific community forms a "reefscape", which can be defined as an architectural unit. Within this unit of typically a width of a few tens of meters, habitats can be diverse, offering living space for various inhabitants (molluscs, crustaceans, fishes, algae, corals, etc.), which are involved in a complex web of ecological interactions.

2.2 Level 2: Reef zone, whole reef

We refer to this level of organization as the "meso-scale" level. Spatially, it typically ranges from few tens of meters to few kilometres. Depending on depth and hydrodynamic conditions, reefscape may change quickly or gradually within a reef zone and within the whole reef (Veron 1986). A complex reef may have several reef zones (fringing reef, barrier reef, reef flat, lagoon, patches, outer slope, channel, etc.), each of them potentially presenting several reefscapes. Conversely, a simple reef may have only a couple of reef zones and few reefscapes. Reef zones are large, yet, as a whole, they are under the influence of the same type of environmental or human forcing and will reflect the influence of perturbations in a relatively unimodal way. Thus reef zones are frequently considered as management units in integrated coastal management or monitoring programs.

2.3 Level 3: Island, region

We refer to this level of organization as the "large-scale" level. Spatially, it typically ranges from few hundreds of meters to hundred of kilometres. It embodies reef complexes, islands, archipelagos and groups of archipelagos belonging to the same unit in terms of biogeography or hydroclimate. Noteworthy at this scale is that interactions between the reef systems and other ecosystems (land, ocean) are implicit. A biogeography region can also be considered as one scale of habitat, since coral distribution and diversity depend on the environmental factors that trigger coral spawning, on the ocean-circulation patterns that physically control the dispersal of passive larvae and, ultimately, evolutionary processes (Veron 2000; Achituv and Dubinsky 1990). This scale is relevant here because it is often considered for management purposes. For instance, network of protected areas or conservation actions are defined within an island, a reef tract, or an archipelago under the same jurisdiction.

3 Human disturbance categories and their effects on coral habitats

The major anthropogenic disturbances affect the physical structure of coral habitats at each organisational level (Table 1). Here, a disturbance is an event that alters the physical environment and/or limits the availability of essential resources (e.g., available substrate) (Pickett and White 1985). This inventory may not be completely exhaustive, but it highlights the major perturbations that have been documented in coral reefs. Furthermore, it is not straightforward to discriminate the relative contributions of natural or man-induced perturbations to the resulting community structure (Grigg and Dollar 1990; Hatcher et al. 1989) since cascading or convoluted effects are common at various time-scales (Quinn and Dunham 1983; Karlson and Hurd 1993; Adjeroud 1997). This convolution of processes explains why management decisions and actions are not a simple endeavor (Fig. 2).

Coastal development, tourist activities, harvesting pressure, accidents and nuclear/weapon testing are the main stressors (Table 1). The increase of human populations on coastal areas promotes constructions and land reclamation for airports, roads, ports, marinas, houses and hotels. This does not only sacrifice reef zones (meso-scale disturbance), but often requires the extraction of coral boulders (small-scale disturbance) in areas that lack alternative building material (e.g., Brown and Howard 1985; Salvat 1987; White 1987). Land reclamation is not limited to modern or developing space-limited countries. Traditional way of life of the Kuna Yala Indians in San Blas archipelago (Panama), and limited space on inhabited islands also result in extensive coral mining and "reef flat filling" (Guzman et al. 2003). At small-scale (colony), tourists eager to enjoy coral reefs can have significant effects by trampling, anchoring, snorkelling, diving or boat groundings (Tilmant 1987; Hawkins and Roberts 1992; Clarke et al. 1993; Allison 1996; Jameson et al. 1999; Tratalos and Austin 2001; Zakai and Chadwick-Furman 2002). At small-scale (colony or community), harvesting using destructive fishing methods, such as dynamite or cyanide fishing, "muro-ami" (driving of fish into large nets attached to the reef) and traps, have a high negative impact (Alcala and Gomez 1987; Eldredge 1987; Gomez and Alcala 1987; Munro et al. 1987; Randall 1987; Johannes and Riepen 1995). Such practices are prohibited in some countries (e.g., Philippines) but laws are not always enforced (Alcala and Gomez 1987). Bombing for military training had a great impact on the reef framework, for instance in Los Vieques Islands (offshore Puerto-Rico). Accidents, which include ship grounding, had a harmful effect on coral reef habitat from colony scale to reef zone (Dollar and Grigg 1981; Hatcher 1984; Hudson and Goodwin 2001). Finally, nuclear testing performed on South Pacific atolls (e.g. Mururoa, Bikini) had significant impacts at meso-scale level

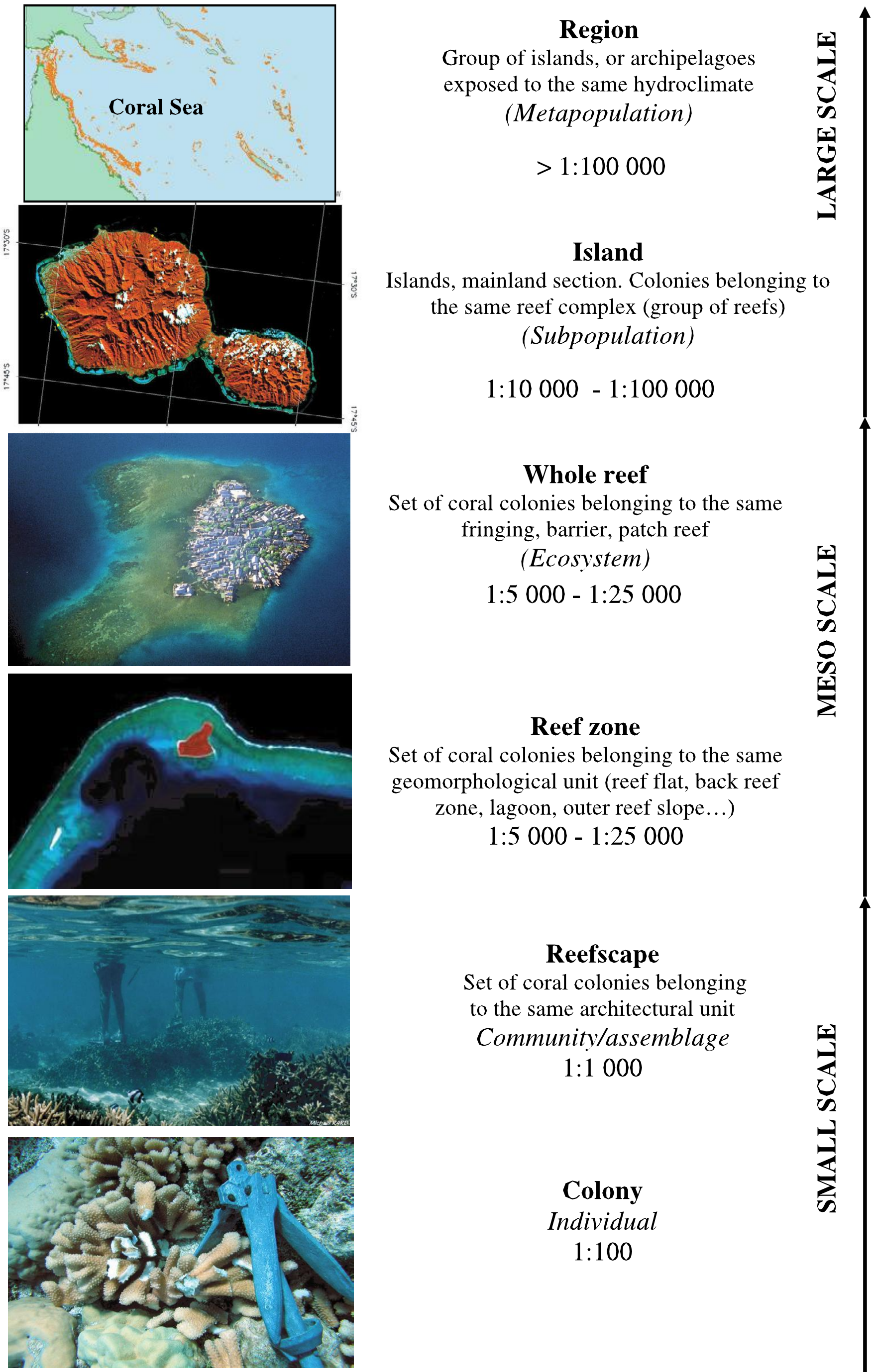

Fig. 1. Multi-scale presentation of coral reef habitats. For each spatial scale (on the right), the spatial pattern (in bold), the ecological function (in italic) and the representative scale are mentioned. Pictures illustrating the small and meso-scales present some related human-induced physical disturbances. Namely, coral colony debris due to anchoring, fishermen walking on a branching coral dominated lagoon reefscape in La Reunion Island, crater generated by atmospheric nuclear blast on the inner slope of the rim of Bikini atoll (Marshall Islands) and land filling of a patch reef flat using coral colonies from the forereef of the same reef in San Blas island (Panama). Island-scale is illustrated by Tahiti island where coastal barrier reefs and fringing reefs are dominant. Region scale is illustrated by the Coral Sea basin which is rimed by the major reef systems of the western Pacific (in orange, incl. New Caledonia, Vanuatu, Salomon Islands, Papua New Guinea and the Great Barrier Reef of Australia. Map source: Reefbase).

Table 1. Characteristics of the major anthropogenic perturbations that affect the physical structure of the habitat by mechanical destruction of stony corals. See Figure 1 for explanation of the spatial scales. Rs: reversible in the short term (years), Rl: reversible in the long term (decades), I: irreversible. 1: punctual, 2: punctual to chronic, 3: chronic. *: speculative factor, as no case-study was reported.

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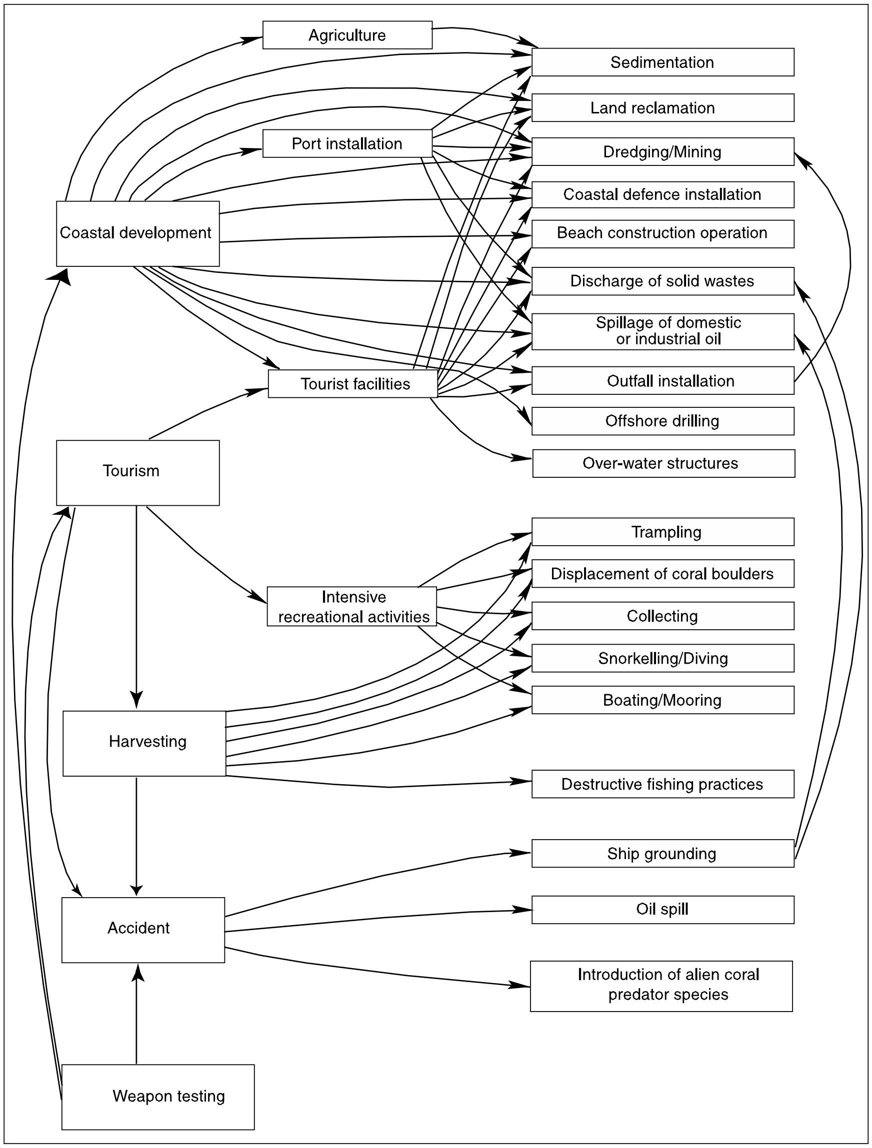

Fig. 2. Cascading causes of coral reef physical degradation. As an example of this "domino effect", nuclear weapons tests done 40 years ago have themselves directly damage the physical foundation of pinnacles or atoll rims, but they are also the initial factor that makes now possible the lucrative wreck-diving activities in "nuclear lagoons" such as Bikini, which itself promote fishing for feeding local and tourist populations and tourist facilities development, which itself enhance the risks of accidents.

on the structure of several sections of the rims and large pinnacles. In Mururoa atoll (French Polynesia), cracks appeared in lagoon bommies and the southern rim collapsed due to the explosion shock wave (Bouchez and Lecomte 1995). In Bikini atoll (Marshall Islands), the first aerial explosions created huge craters along the atoll's rim (Fig. 1).

The human disturbances listed above have various effects that differ in their mode of action, their spatial scale, their intensity and their duration. The same exact disturbance may have a different effect (or perturbation) depending on the moment it strikes the reef and where. For example, dredging and terrigenous inputs, which have important impacts on fringing reef communities of high islands, have generally a negligible impact on the outer slope of high islands and atolls (Salvat et al. 1979; Augustin et al. 1997; Adjeroud et al. 2002; Fabricius 2005). In contrast, diving, ship grounding and nuclear blast testing may affect lagoonal as well as outer reef slope coral communities. Despite their negative effects, some modes of perturbation may effectively create a new coral habitat. This aspect is particularly important for the management and rehabilitation of disturbed areas (Salvat et al. 2002). In general, the effects of disturbances depend on the temporal and

spatial reference scales under consideration, their frequency, the ecological history of the site (e.g., chronology of the previous perturbations), the structure (growth forms, etc.) of the impacted communities, the geomorphology and depth of the reef zone, the confounding influence of any other physical or biotic stresses (Connell 1978; Hughes 1989; Grigg and Dollar 1990; Karlson and Hurd 1993; Meesters and Bak 1993; Hughes 1994; Bak and Nieuland 1995; Connell et al. 1997).

These perturbations may have short-term or immediate direct consequences, as well as long-term and indirect effects mostly at small and meso-scales. Most of the perturbations, compiled in Table 1, affect coral habitats at these two scales. We have not identified a direct human-induced physical perturbation that is specific to the large-scale level. It is only through repetition or generalisation of small-scale disturbances, throughout a region or an island, that human induced physical perturbations become large-scale level disturbance. Otherwise, there are several examples of meso-scale level disturbances that have second-order large-scale influences. For instance, the dredging of a pass in an atoll is a reef-zone physical disturbance, but the resulting modification of the water exchanges between lagoon and ocean may have significant consequences on the equilibrium of the whole island. Several anthropogenic disturbances may look relatively minor compared to natural disturbances, such as cyclones or submarine earthquakes (Hatcher et al. 1989). However, human impacts, when combined with natural disturbances, may significantly affect the recovery process of a reef, particularly since they are often chronic rather than infrequent (Connell et al. 1997).

Some of the disturbances are well documented (e.g., destructive fishing practices), whereas other were rarely studied (e.g., bombing or nuclear blasts testing) (Table 1). In general, physical disturbances result in a reduction in the three dimensional structural complexity of the reefs, reducing the availability of shelters for associated organisms (Aroson and Swanson 1997). Physical destruction may not necessarily kill coral colonies entirely. However, even partial mortality and weakening may favour pathogens infestation and reduce the reproductive potential of individuals (Hunte and Wittenberg 1992; Ward and Harrison 2000; Hall 2001; Nugues and Roberts 2003). Even if coral colonies are not directly damaged, the sediment and rubbles produced by human activities may cover and bury the coral community in place ("smothering" effect). Discharge of solid wastes and oil spill may also cover, totally or partially, the coral colonies in place. There is no real evidence that oil floating above the corals causes noticeable damage, but one may assume that corals living near the surface can be coated by oil and consequently impacted in their physical structure. For further explanations on the perturbations and their effects, we have listed the most relevant literature.

It is often difficult to estimate the duration of the effects associated to a particular perturbation. In fact, several perturbations, such as trampling, collecting, destructive fishing practices or bombing have effects that may be infrequent or chronic. However, other perturbations, such as dredging and beach construction operation, are often chronic, whereas ship grounding can be considered as infrequent perturbations. The impacted coral communities may be irreversibly damaged, or may recover partially or totally. The resilience (i.e., capacity to recover) of the coral community depends on the characteristics (intensity and duration) of the perturbation and on the initial community or colony structure (Connell et al. 1997). It depends also on functional processes (such as herbivory), and the functional overlap (or redundancy) of multiple species in an ecosystem (Nyström et al. 2000; Nyström and Folke 2001; Belwood et al. 2004), on the availability and abundance of local larvae, and on the connectivity with other reef habitats and larval supply (Obura 2005). The concept of "spatial resilience" is differentiated from that of ecological resilience by recent authors (Nyström and Folke 2001; Bengtsson et al. 2003), most important in terms of the spatial scale over which it is applied. Ecological resilience generally applies to properties within the spatial boundaries of an ecosystem. In coral reef studies, this is generally considered to extend up to tens and sometimes hundred kilometres (Obura 2005). Spatial resilience extends beyond this to include large scale functions and processes beyond boundaries of an ecosystem unit. For a coral reef, this would include the processes of connectivity to other reefs by currents and larval dispersal, large-scale oceanographic phenomena such as upwelling in adjacent system and other features that may occur over hundreds to thousands of kilometres (Obura 2005). Furthermore, chronic and low level perturbations may cause more damage to the reefs in the long term than discrete and highly destructive events, because the former do not allow sufficient time for recovery (Davis 1977; Dustan and Halas 1987; Tilmant 1987). Nevertheless, dredging, coastal reclamation, beach construction operation, and coastal installations generally imply that impacted communities have few chances to return to their initial state (i.e. irreversible impacts) (Table 1). For other discrete and weak perturbations, such as collecting, mooring and boating, or snorkelling and diving, impacted communities may return rapidly (years) to their initial structure. For larger scars, due to large ship grounding for instance, recovery time may be higher (decades). In some case, the extent of the disturbances may not prevent communities to return to their initial structure. For destructive fishing practices, small-scale impacts (e.g., individual blasts) do not alter significantly the community structure, whereas generalisation of these impacts at larger scale (e.g., several densely spaced blasts over large portions of a reef) may eventually alter the community structure and the environment, and thereby greatly reduce the potential and rate of recovery (McManus et al. 1997; Riegl and Luke 1998).

Some perturbations may create a new coral habitat (Table 1). For example, dredging, coastal reclamation, sewage discharge and coastal defence installations, or offshore drilling may create a new substrate that can be colonized by corals, thus forming a habitat for other reef species. Trampling, displacement of coral boulders, boating/mooring, snorkelling/diving, ship grounding, destructive fishing practices, discharge of solid wastes, and nuclear blasts testing may form accumulation of dead and live coral rubbles, which may provide habitat for certain fish species (Riegl and Luke 1998). In contrast, beach construction operations, terrigenous inputs, collecting, and oil spill have never been associated with the creation of new habitats. Historical trajectories of reef degradation extending back thousands of years, provide a powerful

tool to explain global patterns and causes of ecosystem collapse, as well to predict future ecosystem states, through an understanding of the sequence of species and habitat loss (Pandofi et al. 2003).

4 The measure of physical disturbances on coral reef habitats

4.1 Scale-dependent indicators of disturbance effects on coral reef habitat structure

The most usual indicators are related to habitat and/or to physical disturbance of habitat (Table 2). Indicator variables are listed according to the spatial scale of the descriptor they are expected to capture. We focus on the three most common categories of descriptors:

- *the stony coral* itself;
- *reef fishes* represented by Chaetodontidae among which many species are coral feeders and dependent of the coral reef habitat, and
- *the human uses* which could have an impact on coral reef habitats. Various variables are proposed as indicators to evaluate the impact of disturbance on these descriptors. We also indicate the methods generally used to obtain data on these variables (see English et al. 1994 for details on the classical methods used to monitor coral reefs), and the sampling unit of the method.

At colony scale (*stony corals* descriptors), the reproductive output (number of planulae per tissue volume) could decrease after repeated breakage (Rinkevich and Loya 1989; Van Veghel and Bak 1994; Rinkevich 1995). This decrease of spawning rate could be followed by a decrease in recruitment rate (number of new corals settling per substratum unit) (Richmond 1997; Zakaï et al. 2000). Recruitment intensity itself may be a useful measure to check if physically damaged reefs are in a way of recovery or not (Kojis and Quinn 2001). To date, the possibility of using other aspects of coral biology as indicators of environmental stress has seldom been explored. Noteworthy are measurements of coral tissue abrasion (damaged tissue that exposed the underlying intact coral skeleton, according to Riegl and Velmirov 1991; Hawkins et al. 1999; Zakai and Chadwick-Furman 2002) or partial mortality in massive corals (percentage of dead surface area per colony according to Brown and Howard 1985; Nugues and Roberts 2003). Nugues and Roberts (2003) proposed the 50%-threshold in dead coral tissue per colony as a simple stress indicator. Such variables may provide a rapid and effective means of detecting sediment stress on coral reefs, for example after dredging operations.

At reefscape or reef zone scale (corresponding to community/assemblage at ecological level), live coral cover and colony number are widely used in coral reef monitoring programs to assess coral reef health (e.g., Global Coral Reef Monitoring Program, Reef Check). The ratio of standing dead coral cover to total cover of both live and dead corals (Gomez et al. 1994) or linear quotes of live coral cover (>75%: excellent, 50–75%: good, 25–50%: fair, <25%: poor) (Gomez and Yap 1988) are also used. Their use as indicators of reef condition in "snapshot" survey is based on the assumption that "healthy" reefs should have high coral cover and coral density (Gomez and Yap 1988; Aronson et al. 1994). However, this assumption could be erroneous in some cases (Thomason and Roberts 1992). Moreover, sites with very high percentage of live coral cover are frequently composed of large monospecific stands of corals, with low coral diversity and spatial complexity (Roberts and Ormond 1987). Nevertheless, in some cases, the percentage of live branching corals or branching associated to live tabular corals has been used to characterise habitat complexity (Chabanet et al. 1997; Lewis 1998). Percentage of live coral cover could be used with other indices such as conservation classes that more accurately predict habitat complexity (Edinger and Risk 2000). Conservation value are estimated using r-K-S (ruderal/competitor/stress-tolerators) ternary diagrams based upon the relative abundance of standardized coral morphology categories: *Acropora* corals as disturbance-adapted ruderals (r), branching non-*Acropora* corals and foliose corals as competition-adapted (K) and massive and submassive corals as stress-tolerators (S). Then, reefs are classified from class 1 ($S > 60\%$) to class 4 ($\%\ r, K, S$ approximately equal). Other authors also estimated habitat complexity from coral morphological diversity (Roberts and Ormond 1987). Indexes of structural complexity or rugosity (ratio contour tape lengtht on stretched tape lengtht) have been also suggested (Risk 1972; Luckhurst and Luckhurst 1978; Dahl 1988). Williams and Polunin (2000) estimated the structural complexity of the substratum on a 6 point-scale (0: no vertical relief to 5: exceptionally complex with high coral cover and numerous caves and over-hangs). Related also to colony scale, "breakage variables" could be used as an indicator of diving pressure in the form of broken coral rubble (Hawkins and Roberts 1994, 1997) or loose fragments adjacent to branching colonies (Zakai and Chadwick-Furman 2002).

At whole reef scale (corresponding to ecosystem at ecological level), clear-cut zonation patterns in a form of serial change in community structure with an increase of water depth are long-established features of shallow water communities. Undisturbed situations provide clear sequences of community changes along transects, while the sequences appear disrupted after dredging operations (Clarke et al. 1993). Following this example, Clarke et al. (1993) proposed an index (Index of Multivariate Seriation) that measures the degree to which a coral community compares relative to a linear sequence. Furthermore, attributes such as "Reef Quality Index" (quality not acceptable if hard coral cover < 30%, recently broken coral >5%, recently dead coral > 3% and coral rubble cover > 5% according to Jameson 1998) or "Coral Damage Index" (quality not acceptable if broken coral colonies ≥ 4%, coral rubble cover ≥ 3% according to Jameson et al. 1999, 2001) could be used globally to gauge the severity and extent of physical damages, and focus managers on areas that need dive site management programs (e.g. mooring buoys).

Using *fish communities* descriptors, Chaetodontidae (butterflyfish) have been proposed as indicator of coral reef "vitality" (e.g. Reese 1981; Sano et al. 1984; Öhman et al. 1998). The underlying simple hypothesis is that since some feed on corals, if corals decline, then populations of corallivorous butterflyfish should also decline or change their feeding

Table 2. Descriptors (stony corals, butterflyfish and human uses), indicators of the impact of physical disturbances related to spatial scale (and ecological function in italic). The major references, the sampling size and the protocols usually used to obtain data of the descriptor attribute are also mentioned. LIT: Line Intercept Transect, PIT: Point Intercept Transect, RST*: Remote Sensus Techniques in development. Ref: same ref. than for abundance except the ones in italic.

	Spatial scales	Indicators	References	Sampling size	Protocols
STONY CORALS	Colony *(inidvidual)*	*Reproduction* Reproductive output, settlement rate	Van Veghel and Bak (1994), Richmond (1997), Zakai et al. (2000), Fox (2004)	100–200 cm^2	Microscopic examination, settlement plates (tiles) collected in situ
		Damage Tissue abrasion	Brown and Howard (1985), Hawkins and Roberts (1997), Hawkins et al. (1999), Zakai and Chadwick-Furman (2002)	10 m	Transects (LIT), photographs, RST* (reflectance)
		Partial mortality in massive corals	Ginsburg et al. (1996), Nugues and Roberts (2003)	1–40 m^2	Belt transects, quadrats, photographs
	Reefscape / Reef zone *(Community/ assemblage)*	*«Reef vitality»* % hard coral cover	De Vantier (1986), Gomez and Yap (1988), Grigg and Dollar (1990), Naim (1993), Aronson et al. (1994), English et al. (1994), Chabanet et al. (1997), Lewis (1997, 1998), Mumby et al. (2001)	20 m 1–300 m^2 ± 100 km^2	Transects (LIT, PIT) Quadrats, belt transect, video mapping Manta tow, Hyperspectral airbone survey*
		Coral vitality index	Dustan (1994), Gomez et al. (1994)	20–50 m	Transects (LIT)
		Morphology % lifeform	Edinger and Risk (2000)		
		% tabular and/or branching coral	Chabanet et al. (1997), Lewis (1998), Joyce and Phinn (2002)	100–300 m^2	Video mapping, Bidirectional reflectance of corals*
		Architecture Structural complexity, rugosity	Risk (1972), Luckhurst and Luckhurst (1978), Williams and Polunin (2000), Brock et al. (2004)	25 m	Transects (LIT) Lidar airbone survey*
		Breakage % broken corals (BC)	Rogers et al. (1983), Hawkins and Roberts (1994, 1997)	20 m 1–10 000 m^2	Transects (LIT, PIT) Belt transect, quadrats (± photographs)
		% BC adjacent to branching corals	Zakai and Chadwick-Furman (2002)		
	Whole reef *(Ecosystem)*	*Zonation pattern* Index of Multivariate Seriation	Clarke et al. (1993)	10 m	Transects (LIT)
		Aesthetic Reef Quality Index (RQI)	Jameson (1998)	10–20 m	Transect (LIT)
		Coral Damage Index (CDI)	Jameson et al. (1999, 2001)	± 100 km^2	Daily observations (boats, divers, snorkelers…)
FISHES	Reefscape / Reef zone *(Community/ assemblage)*	Abundance	Reese (1981), Sano et al. (1984), Williams (1986), Roberts and Ormond (1987), Hourrigan et al. (1988), Bouchon-Navaro and Bouchon (1989), *Fowler (1990), Cox (1994)*, Öhman et al. (1998), Cadoret et al. (1999)	20–50 m 40–200 m^2	Transects (LIT, PIT) Belt transect, point counts, video
		Species richness	Ref. Bell and Galzin (1984), Findley and Findley (1985)		
		Territory size, monogamous pairs occurrence	Reese (1981), Hourrigan et al. (1988), Crosby and Reese (1996)		
USES	Whole reef	Diver carrying capacity	Dixon et al. (1993), Chadwick-Furman (1996), Hawkins and Roberts (1997), Zakai and Chadwick-Furman (2002)	± 100 km^2	Census from plane or boat Questionnaires, survey of dive centres
	Island	Diver preference	Andersson (1998), Williams and Polunin (2000)	± 100 km^2	Questionnaires, underwater survey (fish and habitat)

behaviour. However, in some cases, the actual correlation was low (Roberts and Ormond 1987; Fowler 1990). Nevertheless, species richness and abundance of chaetodontids have often been included into monitoring programs since volunteers without specific experience can easily conduct surveys on these easy-to-identify populations (Hodgson 1999; Conand et al. 2000; Crosby and Reese 1996).

The human uses of coral reef ecosystems is represented here by recreational scuba diving activities which is an important and growing component of the tourism market (Moberg and Folke 1999). The diver preferences for certain reef attributes were classified by Williams and Polunin (2000). These authors rank 14 attributes (e.g. "reef structure", "big fish", "variety of fishes", "variety of corals", "coral cover", "unusual fish", "sponges", etc.) on a scale from 0 (not at all important) to 5 (most preferred). Furthermore, some authors used the concept of "diver carrying capacity" which is the number of dives per site and per year that a reef can tolerate without becoming significantly degraded (Dixon et al. 1993; Chadwick-Furman 1996; Hawkins and Roberts 1997). Hawkins and Roberts (1997) suggests that reefs in the Red Sea and Caribbean can sustainably support around 5000−6000 dives per site per year, but that greater levels of use cause a rapid rise in diver damages.

Most of the variables measure disturbance effects on scale ranging from individual to community (Table 2). There is a paucity of indicator variables measuring habitat attributes at large spatial scale. These variables are less common because of the cost linked with this kind of studies and the difficulties to carry them out. Using remote sensing techniques, environmental impacts could be easier to measure at larger scales. For instance, remote sensing observations provide unambiguous measurement of changes in shorelines and alteration of reef zones due to land reclamation, dredging or waste disposal (e.g. the so-called "trash island" in Male atoll, Maldives). Several of these techniques are still largely exploratory and have not been validated on a sufficient number of case studies. Nevertheless, we mention key reports that clearly offer interesting perspectives in measuring synoptically coral mortality, using airborne hyperspectral data (Mumby et al. 2001), reef rugosity using LIDAR, i.e. airborne laser (Brock et al. 2004), habitat diversity and patchiness using high resolution satellite imagery (Andréfouët et al. 2003), and changes in habitat structure using time-series of images (Palandro et al. 2003). In addition, at colony-scale, *in situ* optical techniques now investigate the possibility to diagnose early a perturbation using changes in the reflectance or fluorescence of the colonies. Changes in optical measurement reveal changes in pigmentation potentially linked to a stress (Yamano et al. 2003). Finally, current research also assesses the variability of colony-scale reflectance according to their morphology (Joyce and Phinn 2002).

4.2 Strategy and criteria for assessing and monitoring coral reef habitat

Managers have to consider various options when conceiving an assessment of a coral habitat. Our goal is not to propose an exhaustive guideline on indicator selection, but to provide references and underline key concepts as sequentially presented (Fig. 3).

It is common sense to state that selection of the most appropriate bioindicators for a particular assessment or monitoring program depends on the objectives of that program (Dale and Beyeler 2001). We identified three broad categories of objectives (Fig. 3):

- To monitor trends in habitat conditions across time, in order to measure whether specific management actions improved habitats conditions, or whether the habitat has reached a level of disturbance for which some type of actions are required (*Objective O1*). The monitoring can be specifically designed to address one pre-identified disturbance, or can target a wide spectrum of disturbances.
- To make a single assessment of the initial status of the environment (*Objective O2*). This status describes habitat conditions after a perturbation has been identified (e.g. ship grounding), or draws an initial picture of habitat conditions before some type of planed disturbances occur (e.g. dredging). This objective can be a prelude to objective O1 (monitoring).
- To improve knowledge and use of existing indicators or test new indicators *(Objective O3)*.
  This methodological objective is generally designed to improve the cost-effectiveness of currently applied methods. It aims to test experimentally some hypothesis or it tries to identify hypotheses that will be tested afterwards.

In addition, a management plan can be designed specifically to address one type of disturbance (*Hypothesis H1*), but some organisations have launched general monitoring plan at large scale for an entire region without a specific disturbance in mind (*Hypothesis H2*). The objectives will have to be carefully considered within these broad limits.

A variety of indicators with different generic properties need to be considered (Jope 2001). *Stressor indicators* measure the stressor itself (e.g., sediments in the water column after a dredging operation). The drawback is that there is no indication of consequences on the habitat themselves. *Exposure indicators* measure the amount of stressor to which the habitat is exposed (e.g., number of reef-walkers in a tourist area). These could be used as a diagnostic indicator as they are specific to the stressor. *Response indicators* measure changes occurring on the habitats (e.g., coral cover); however they do not necessarily identify the cause of the changes. The specificity of a response indicator is a key criterion. Response indicators can be specific and have a threshold or gradual response to a specific type of disturbance. Non-specific indicators will reveal that something is happening but not the causality. However, a range of non-specific indicators may be better than one specific indicator to draw the status of habitats at different scales. Most of the variables or attributes are *response indicators* (Table 2) as they measure changes occurring in the system (Jope 2001). They provide a better indication of ecological attribute conditions (habitat component), than ecological effects due to a specific disturbance. For example, by the time census methods have detected broken corals, these corals have already suffered damage and further efforts must focus on preventing more damage and death. Conversely, "diver carrying capacity" may be considered as *exposure indicator* as it measures

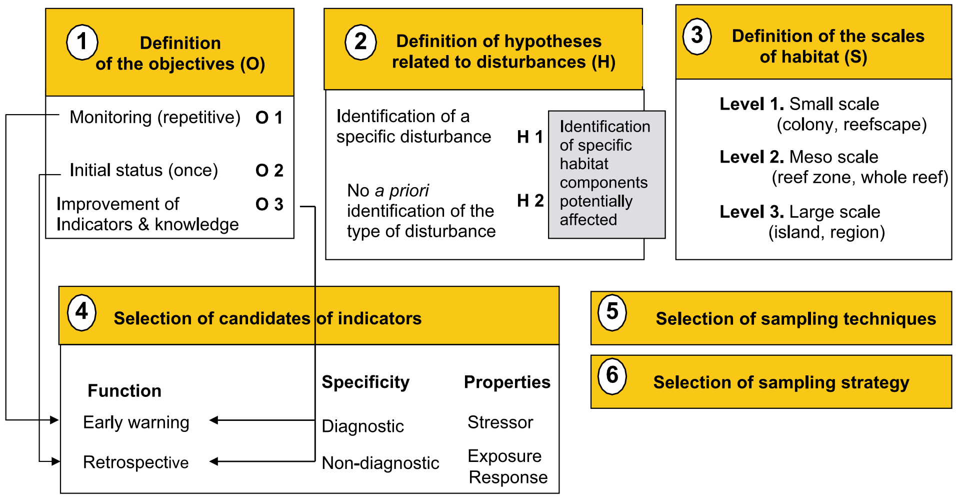

Fig. 3. Framework of sampling design for assessing indicators (e.g. coral reef habitat).

the amount of stressor to which the system is exposed. If specific to the stressor, this indicator may be considered as a diagnostic indicator. Non-diagnostic indicators may reflect changes (Rapport et al. 1985; Jope 2001), but not specifically to one of the disturbances (Table 1).

To complete this general classification of indicators, other properties such as sensitivity (the capacity to reveal gradations in response to stress) are of interest (Jameson 1998). This anticipatory quality specifies whether the indicator can provide *early-warning* signal (useful in case of monitoring trends in environmental conditions over the time), or is *retrospective*, providing evidence of ecosystem change after the change has occurred (Rapport et al. 1985).

The scale of work is one of the main considerations. Scale in this context depends directly on the objectives and the hypotheses which depend on the considered specific disturbance. Willingness to draw a general picture of coral habitats (Objective O2) without specific disturbances in mind (Hypothesis H2) will imply that a wide range of scale needs to be addressed. For instance, reefscape (or community) to regions can be studied by multiplying the numbers of regional sites where community measurements will be performed. Unfortunately, no single indicator is applicable directly across all spatial scales of concern (Dale and Beyeler 2001). Therefore, combining indicators at different levels of the biological organisation represents an optimal strategy, because these measures serve different purposes, from individual to communities (Hallock et al. 2004). Measures on colony potentially provide the earliest warning of possible deterioration while measures on community give a better indication of the ecological importance and magnitude of the disturbances and their consequences on communities including humans (Rapport et al. 1985; Underwood and Peterson 1988). Indicator selection depends on several additional criteria: the intrinsic quality of the measure itself (depending of the sampling techniques and of the choice of the variable) and the "effectiveness" that gather sampling strategy and the statistical analysis.

4.3 A hierarchical concept of disturbance in coral reefs in perspectives

Using a multi-scale approach allows to present the various indicators of (physical) disturbances in a logical suite. However, there is still a lack of explicit relationship between the observed physical impacts on reefs and what these impacts means in terms of alteration of the biological processes occurring on the reef. Another framework focussing on ecosystem functions and integrating the notions of disturbance, levels of organisation, scale, and indicators of perturbations could be a next logical step. Pickett et al. (1989) have proposed such a conceptual framework. By organising each ecological question within a so-called hierarchical model, they distinguish among entities (the object of interest, susceptible of being disturbed), function (set of interactions among entities), and structure (resulting complex of interacting entities). Though conceptually interesting and theoretically better suited to analyse multi-stressor effects throughout different ranges of scales and functions, the design and selection of indicators remain quite problematic. It is definitely recommended that scientists try to visualize the integration of methods within such conceptual frameworks (Hallock et al. 2004). However, the amount of indicators practical for managers remains limited, but new developments still occur. For instance, recent advances in molecular biology should aid in the accurate diagnostic of coral condition by "visualizing" coral stress using Molecular Biomarker System (MBS) or gene expression. For the first step, MBS was use to assess the physiological status of coral challenged under heat stress, using specific cellular and molecular parameters (Downs et al. 2000). However, transplantation experiments must be conducted to examine how stressors in natural populations induce gene expression and to determine whether these potential diagnostic indicators are effective and specific.

5 Conclusion

Indicators are essential tools for monitoring the state of the coastal environment. They can inform managers and policy

makers of the effectiveness of strategies in achieving sustainability and need to be based on rigorous scientific, social and economic research. However, the suite of options for managers is limited. This review shows that the majority of the indicators of human-induced physical disturbances are non-specific. They can be categorized in few categories based on their properties, but they can't solve all problems. We followed a multi-scale discussion which eventually shows the difficulties for the managers and scientists to have a continuum of answers and indicators across space and time. Tools are needed to identify and rank coral responses to multiple stressors and to determinate which stressors having the greatest effects. Theoretically, a hierarchical scheme could be a logical new integrating scheme since they target functions across scales, but similar models are still in their infancy in the case of coral reef ecosystems. On a practical standpoint, managers and policymakers still need to understand the effects of man-induced disturbances, be able to properly assess these damages, and develop subsequent restoration and conservation efforts on reefs under their stewardship.

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References

Achituv Y., Dubinsky Z., 1990, Evolution and zoogeography of coral reefs. In: Dubinsky Z. (Ed.), Ecosystems of the world, Elsevier, pp. 1-9.

Adjeroud M., 1997, Factors influencing spatial patterns on coral reefs around Moorea, French Polynesia. Mar. Ecol. Prog. Ser. 159, 105-119.

Adjeroud M., Augustin D., Galzin R., Salvat B., 2002, Natural disturbances and interannual variability of coral reef communities on the outer slope of Tiahura (Moorea, French Polynesia): 1991 to 1997, Mar. Ecol. Prog. Ser. 237, 121-131.

Alcala A.C., Gomez E.D., 1987, Dynamiting coral reefs for fish: a resource-destructive fishing method. In: Salvat B. (Ed.), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 51-60.

Allison W.R., 1996, Snorkeler damage to reef corals in the Maldive Islands. Coral Reefs 15, 215-218.

Andersson J., 1998, The value of coral reefs for the current and potential tourism industry in Unguja. In: Johstone L., Francis C., Muhando C. (Eds.), Coral Reefs: values, Threats and Solutions. Proc. Nat. Conf. on coral reefs, Nairobi, Kenya, pp. 81-90.

Andréfouët S., Kramer P., Torres-Pulliza D., Joyce K.E., Hochberg E.J., Garza-Perez R., Mumby P.J., Riegl B., Yamano H., White W.H., Zubia M., Brock J.C., Phinn S.R., Naseer A., Hatcher B.G., Muller-Karger F.E., 2003, Multi-sites evaluation of IKONOS data for classification of tropical coral reef environments. Remote Sens. Environ. 88, 128-143.

Aroson R.B., Swanson D.W., 1997, Evolutionary paleoecology of Caribbean reef coral. In: Allmon W.D. and Bottjer D.J. (Eds). Evolutionary paleoecology: the ecological context of macroevolutionary change. Columbia University Press, New York, pp. 171-233.

Aroson R.B., Edmunds P.J., Precht W.F., Swanson D.W., Levitan D.R., 1994, Large-scale, long term monitoring of Caribbean coral reefs: simple, quick, inexpensive techniques. Atoll Res. Bull. 421.

Augustin D., Galzin R., Legendre P., Salvat B., 1997, Variation interannuelle des peuplements récifaux du récif-barrière de Tiahura (île de Moorea, Polynésie française). Oceanol. Acta 20, 743-756.

Bablet J.P., Perrault G.H., 1987, Effects on a coral environment of a nuclear detonation. In: Salvat B. (Ed.), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 151-163.

Bak R.P.M., 1978, Lethal and sublethal effects of dredging on reef corals. Mar. Pollut. Bull. 9, 14-16.

Bak R.P.M., 1987, Effects of chronic oil pollution on a Caribbean coral reef. Mar. Pollut. Bull. 18, 534-539.

Bak R.P.M., Nieuwland G., 1995, Long-term changes in coral communities along depth gradients over leeward reefs in the Netherlands Antilles. Bull. Mar. Sci. 56, 609-619.

Bell P.R.F., 1992, Eutrophication and coral reefs-some examples in the Great Barrier Reef lagoon. Water. Res. 26, 553-568.

Bell J.D., Galzin R. 1984, Influence of live coral cover on coral-reef fish communities. Mar. Ecol. Prog. Ser. 15, 265-274.

Bellwood D.R., Hughes T.P., Folke C., Nyström M., 2004, Confronting the coral reef crisis. Nature 429, 827-833.

Bengtsson J., Angelstam P., Elmqvist T., Emanuelson U., Folke C., Ihse M., Moberg F., Nystrom M., 2003, Reserves, resilience and dynamic landscape. Ambio 32, 389-396.

Berg H., Öhman M., Troëng S., Linden O., 1998, Environmental economics of coral reef destruction in Sri Lanka. Ambio 27, 627-634.

Bouchez J., Lecomte R., 1995, Les atolls de Mururoa et de Fangataufa (Polynésie française), II : les experimentations nucléaires, effets mécaniques, lumino-thermiques, électromagnétiques. Masson, Paris.

Bouchon Navaro Y., Bouchon C. 1989, Correlations between chaetodontid fishes and coral communities of the Gulf of Aqaba (Red Sea). Environ. Biol. Fish. 25, 47-60.

Brock J., Wright C., Clayton T., Nayegandhi A., 2004, Optical rugosity of coral reefs in Biscayne National Park, Florida. Coral Reefs 23, 48-59.

Brown B.E., Howard L.S., 1985, Assessing the effects of "stress" on reef corals. Adv. Mar. Biol. 22, 1-63.

Brown B.E., Dunne R.P., 1988, The impact of coral mining on coral reefs in the Maldives. Environ. Conserv. 15, 159-165.

Bruckner A.W., Bruckner R.J., 2001, Condition of restored *Acropora palmata* fragments off Mona Island, Puerto Rico, 2 years after the Fortuna Reefer ship grounding. Coral Reefs 20, 235-243.

Bruggeman J.H., 1994, Parrotfish grazing on coral reefs: a trophic novelty. PhD Univ. Groningen.

Burns K.A., Knap A.H., 1989, The Bahia Las Minas oil spill hydrocarbon uptake by reef building corals. Mar. Pollut. Bull. 20, 391-398.

Burns K.A., Ehrhardt M.G., Howes B.L., Taylor C.D., 1993, Subtidal benthic community respiration and production near the heavily oiled Gulf coast of Saudi Arabia. Mar. Pollut. Bull. 27, 199-205.

Cadoret L., Adjeroud M., Tsuchiya M. 1999, Spatial distribution of chaetodontid fish in coral reefs of the Ryukyu Islands, southern Japan. J. Mar. Biol. Assoc. UK 79, 725-735.

Carpenter K.E., Alcala A.C., 1977, Philippines coral reef fisheries resources. Part II. Muro-Ami and Kayakas reef fisheries, benefit or bane? Philipp. J. Fish. 15, 217-235.

Chabanet P., Ralambondrainy H., Amanieu M., Faure G., 1997, Relationship between coral reef substrata and fish. Coral Reefs 16, 93-102.

Chadwick-Furman N.E., 1996, Effects of scuba diving on coral reef invertebrates in the U.S. Virgin Islands: implications for management of diving tourism. Proc. 6th Int. Coelenterate Bio. Symp., Amsterdam.

Clarke K.R., Warwick R.M., Brow B.E., 1993, An index showing breakdown of seriation, related to disturbance, in a coral-reef assemblage. Mar. Ecol. Prog. Ser. 102, 153-160.

Conand C., Chabanet P., Bigot L., Quod J.P., 2000, Guidelines for coral reef monitoring in the south west region of the Indian Ocean. Handbook PRE/COI, 27.

Connell J.H., 1978, Diversity in tropical rain forests and coral reefs. Science 199, 1302-1310.

Connell J.H., Hughes T.P., Wallace C.C., 1997, A 30-year study of coral abundance, recruitment, and disturbance at several scales in space and time. Ecol. Monogr. 67, 461-488.

Constanza R., D'Arge R., deGroot R., Farber S., Grasso M., Hannon B., Limburg K., Naeem S., O'Neill R., Paruelo J., Raskin R., Sutton P., van den Belt M., 1997, The value of the world's ecosystem services and natural capital. Nature 387, 256.

Cox E.F., 1994, Resource use by corallivorous butterflyfishes (family Chaetodontidae) in Hawaii. Bull. Mar. Sci. 54, 535-545.

Crosby M.P., Reese E.S., 1996, A manual for monitoring coral reefs with indicator species: butterflyfishes as indicators of change on Indo-Pacific reefs. Silver Spring, MD: Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, 45 p.

Dahl A.L., 1988, Surface area in ecological analysis: quantification of benthic coral-reef algae. Mar. Biol. 23, 239-249.

Dale V.H., Beyeler S.C., 2001, Challenges in the development and use of ecological indicators. Ecol. Indic. 1, 3-10.

Davis G.E., 1977, Anchor damage to a coral reef on the coast of Florida. Biol. Conserv. 11, 29-34.

De Vantier L.M., 1986, Studies in the assessmant of coral reef ecosystems. In: Brown B.E. (Ed.) "Human induced damage to coral reefs". Unesco Rep. Marine Science 40, 99-111.

Dixon J.A, Scura L.F., van't Hof T., 1993, Meeting ecological and economic goals: marine parks in the Caribbean. Ambio 22, 117-125.

Dodge R.E., Wyers S.C., Frith H.R., Knap A.H., Smith S.R., Sleeter T.D., 1984, The effects of oil and oil dispersants on the skeletal growth of the hermatypic coral *Diploria strigosa*. Coral Reefs 3, 191-198.

Dollar S.J., Grigg R.W., 1981, Impact of Kaolin clay spill on a coral reef in Hawaii. Mar. Biol. 65, 269-276.

Done T.J., 1992, Phase shifts in coral reef communities and their ecological significance. Hydrobiologia 247, 121-132.

Done T.J., Ogden J.C., Wiebe W.J., Rosen R.B., 1996, Biodiversity and ecosystem function of coral reefs. In: Mooney H.A., Cusman J.H., Medina E., Sala O.E., Schulze E.D. (Eds.), Functional roles of biodiversity: global perspectives. Wiley and Sons Ltd, London, pp. 393-423.

Downs C.A., Mueller E., Philipps S., Fauth J.E., Woodley C.M., 2000, A molecular biomarker system for assessing the health of coral *(Montastrea faveolata)* during heat stress. Mar. Biotechnol. 2, 533-544.

Dustan P., Halas J.C., 1987, Changes in the reef-coral community of Carysfort Reef, Key Largo, Florida, 1974 to 1982. Coral Reefs 6, 91-106.

Dustan P., 1994, Developing methods for assessing coral reef vitality: a tale of two scales. Proc. Colloq. Global aspects of coral reefs: health, hazards and history, pp. 38-45.

Edinger P., Risk M., 2000, Reef classification by coral morphology predict coral reef conservation value. Biol. Conserv. 92, 1-13.

Eldredge L.G., 1987, Poisons for fishing on coral reefs. In: Salvat, B. (Ed), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 61-66.

English S., Wilkinson C., Baker V., 1994, Survey manual for tropical marine resource. Australian Institute of Marine Science.

Epstein N., Bak R.P.M., Rinkevich B., 2000, Toxicity and third generation dispersants and dispered Egyptian crude oil on Red Sea coral larvae. Mar. Pollut. Bull. 40, 497-503.

Erdmann M.V., 2000, Destructive fishing practices in Indonesian seas. In: Sheppard C. (Ed.), Seas at the millenium: an environmental evaluation. Pergamon, Amsterdam, pp. 392-393.

Fabricius K.E., 2005, Effects of terrestrial runoff on the ecology of corals and coral reefs: review and synthesis. Mar. Pollut. Bull. 5, 125-146.

Findley J.S., Findley M.T., 1985, A search for pattern in butterfly fish communities. Am. Nat. 126, 800-816.

Fowler A.J., 1990, Spatial and temporal patterns of distribution and abundance of chaetodontid fishes at One Tree Reef, southern GBR. Mar. Ecol. Prog. Ser. 64, 39-53.

Fox H., 2004, Coral recruitment in blasted and unblasted sites in Indonesia: assessing rehabilitation potential. Mar. Ecol. Prog. Ser. 269, 131-139.

Fox H.E., Mous P., Pet J., Muljadi A., Caldwell, R.L., 2005, Experimental assessment of coral reef rehabilitation following blast fishing. Conserv. Biol.19, 98-107.

Fucik K.W., Bright T.J., Goodman K.S., 1984, Measurements of damage, recovery, and rehabilitation of coral reefs exposed to oil. In: Cairns J., Buikema A.L. (Eds.), Restoration of habitats impacted by oil spills. Butterworth, London, pp. 115-133.

Galvez R., Sadorra M.S., 1988, Blast fishing: a Philippine case study. Trop. Coast. Area Manage. 3, 9-10.

Gattuso J.P., Pichon M., Delesalle B., Frankignoulle M., 1993, Community metabolism and air-sea CO2 fluxes in a coral reef ecosystem (Moorea, French Polynesia). Mar. Ecol. Prog. Ser. 96, 259-267.

Gattuso J.P., Allemand D., Frankignoulle M., 1999, Interactions between the carbon and carbonate cycles at organism and community level in coral reefs: a review on process and control by the carbonate chemistry. Am. Zool. 39, 160-183.

Ginsburg R.N., Bak R.P.M., Kiene W.E., Gischler E., Kosmynin V., 1996, Rapid assessmentof of reef condition using coral vitality. Reef Encounter 19, 12-14.

Gomez E.D., Alcala A.C., Yap H.T., 1987, Other fishing methods destructive to coral. In: Salvat B. (Ed.), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 67-75.

Gomez E.D., Yap H.T., 1988, Monitoring reef condition. In: Kenchington R.A. and Hudson B. (Ed.), Coral reef management handbook UNESCO regional office for science and technology for southeast Asia (ROSTSEA), Jakarta, pp. 171–178.

Gomez E.D., Alino P.M., Yap H.T., Licuanan W.Y., 1994, A review of the status of Philippines reefs. Mar. Pollut. Bull. 29, 62-68.

Goreau T.F., 1959, The physiology of skeleton formation in corals. I. A method for measuring the rate of calcium deposition by corals under different conditions. Biol. Bull. 116, 59-75.

Grigg R.W., 1983, Community structure, succession and development of coral reefs in Hawaii. Mar. Ecol. Prog. Ser. 11, 1-14.

Grigg R.W., 1984, Resource management of precious corals: a review and application to shallow water reef building corals. Mar. Ecol. 5, 57-74.

Grigg R.W., Dollar S.J., 1990, Natural and anthropogenic disturbance on coral reef ecology. In: Dubinsky Z. (Eds.), Ecosystems of the world 25, Coral reefs. Elsevier, Amsterdam, pp. 439-452.

Guzman H.M., Jimenez C.E., 1992, Contamination of coral reefs by heavy metals along the Caribbean coast of Central America (Costa Rica and Panama). Mar. Pollut. Bull. 24, 554-561.

Guzman H.M., Holst I., 1993, Effects of chronic oil-sediment pollution on the reproduction of the Caribbean reef coral Siderastrea siderea. Mar. Pollut. Bull. 26, 282.

Guzman H.M., Castillo A., 2003, Natural disturbances and mining of Panamanian coral reefs by indigenous people. Conserv. Biol. 17, 1396-1401.

Guzman H.M., Jackson J.B.C., Weil E., 1991, Short-term ecological consequences of a major oil spill on Panamanian subtidal reef corals. Coral Reefs 10, 1-12.

Hall V.R., 2001, The response of *Acropora hyacinthus* and *Montipora tuberculosa* to three different types of colony damage: scraping injury, tissue mortality and breakage. J. Exp. Mar. Biol. Ecol. 264, 209-223.

Hallock P., Barnes K., Fisher E.M., 2004, Coral-reef risk assessment from satellites to molecules: a multi-scale approach to environmental monitoring and risk assessment of coral reefs. Environ. Micropaleont. Microbiol. Meiobenthol. 1, 11-39.

Hatcher B.G., 1984, A maritime accident provides evidence for alternate stable states in benthic communities on coral reefs. Coral Reefs 3, 199-204.

Hatcher B.G., Johannes R.E., Robertson, A.I., 1989, Review of research relevant to the conservation of shallow water tropical marine ecosystems. Oceanogr. Mar. Biol. Ann. Rev. 27, 337-414.

Hawkins J.P., Roberts C.M., 1992, Effects of recreational SCUBA diving on fore-reef slope communities of coral reefs. Biol. Conserv. 62, 171-178.

Hawkins J.P., Roberts C.M., 1993, Effects of recreational SCUBA diving on coral reefs: trampling on reef-flat communities. J. Appl. Ecol. 30, 25-30.

Hawkins J.P., Roberts C.M., 1994, The growth of coastal tourism in the Red Sea: present and future effect on coral reefs. Ambio 23, 503-508.

Hawkins J.P., Roberts C.M., 1997, Estimating the carrying capacity of coral reef for scuba diving. Proc. 8th Int. Coral Reef Symp. 2, 1923-1926.

Hawkins J.P., Roberts C.M., VanHof T., deMeyer K., Tratalos J., Aldam C., 1999, Effects of recreational scuba diving on Caribbean coral and fish communities. Conserv. Biol 13, 888-897.

Hodgson G., 1999, A global assessment of human effects on coral reefs. Mar. Pollut. Bull. 38, 345-355.

Hoegh-Guldberg O., 1999, Climate change, coral bleaching and the future of the world's coral reefs. Mar. Freshw. Res. 50, 839-866.

Hourigan T.F., Tricas T.C., Reese E.S., 1988, Coral Reef Fishes as Indicators of Environmental Stress in Coral Reefs. In: Soule, D. F., Kleppel, G. S. (Eds.), Marine Organisms as Indicators. Springer-Verlag, pp. 107-135.

Hudson J.H., Goodwin W.B., 2001, Assessment of vessel grounding injury to coral reef and seagrass habitats in the Florida Keys National Marine Sanctuary, Florida: protocol and methods. Bull. Mar. Sci. 69, 509-516.

Hudson J.H., Shinn E.A., Robbin D.M., 1982, Effects of offshore oil drillings on Philippine reef corals. Bull. Mar. Sci. 32, 890-908.

Hughes T.P., 1989, Community structure and diversity of coral reefs: the role of history. Ecology 70, 275-279.

Hughes T.P., 1994, Catastrophes, phase shifts and large scale degradation of a Caribbean coral reef. Science 265, 1547-1551.

Hughes T.P., Connell J.H., 1999, Multiple stressors on coral reefs: a long-term perspective. Limnol Oceanogr 44, 932-940.

Hughes T.P., Baird A., Belwood D.R., Card M., Connolly S.R., Folke C., Grosberg R., Hunte W., Wittenberg M., 1992, Effects of eutrophication and sedimentation on juvenile corals. II Settlement. Mar. Biol. 114, 625-631.

Hutchings P., 1986, Biological destruction of coral reefs: a review. Coral Reefs 4, 239-252.

Jackson J.B.C., Cubit J.D., Keller B.D., Batista V., Burns K., Caffey H.M., Caldwell R.L., Garrity S.D., Getter C.D., Gonzalez C., Guzman, E.M. Kaufmann, K.W. Knap, A.H. Levings, S.C. Marshall, M.J. Steger R., Thompson R.C., Weil E., 1989, Ecological effects of a major oil spill on Panamanian coastal marine communities. Science 243, 37-44.

Jackson J.B.C., Kirby M., Berger W., Bjorndal K., Botsford L., Bourque B., Bradbury R., Cooke R., Erlandson J., Estes J., Hughes T., Kidwell S., Lange C., Lenihan H., Pandolfi J., Peterson C., Steneck R., Tegner M., Warner R., 2001, Historical overfishing and the recent collapse of coastal ecosystem. Science 293, 629-638.

Jameson S.C., 1998, Twelve reefs at risk: red Sea Riviera. In: Bryant D., Burke L., Mc Manus J., Spalding M. (Eds.), Reefs at risk: a map based indicator of potential threats of the world's coral reefs. World Resources Institute, Washington DC.

Jameson S.C., Ammar M.S., Saadalla E., Mostafa H.M., Riegl B., 1999, A coral damage index and its application to diving sites in the Egyptian Red Sea. Coral Reefs 18, 333-339.

Jameson S.C., Erdmann M.V., Karr J.R., Potts K.W., 2001, Charting a course toward diagnostic monitoring: a continuing review of coral reef attributes and a research strategy for creating coral reef indexes of biotic integrity. Bull. Mar. Sc. 69, 701-744.

Johannes R.E., Maragos J.E., Coles S.L., 1972, Oil damaged corals exposed to air. Mar. Pollut. Bull. 3, 29-30.

Johannes R.E., Riepen M., 1995, Environmental, Economic, and Social implications of the live reef fish trade in Asia and the Western Pacific. Report to the Nature Conservancy and the South Pacific Forum Fisheries Agency.

Jope K.L., 2001, An approach to identifying "vital signs" of ecosystem health. In: Harmon D. (Ed.), Proc. 11th Conf. Research and resource management in parks and on public lands, pp. 399-406.

Joyce K.E., Phinn S.R., 2002, Bi-directional reflectance of corals. Int. J. Remote Sensing 23, 389-394.

Karlson R.H., Hurd L.E., 1993, Disturbance, coral reef communities, and changing ecological paradigms. Coral Reefs 12, 117-125.

Kay A.M., Liddle M.J., 1989, Impact of human trampling in different zones of a coral reef flat. Environ. Manage. 4, 509-520.

Kinsey D.W., 1985, Metabolism, calcification and carbon production. I. System level studies. Proc. 5th Int. Coral Reef Symp. 4, 505-526.

Kleypas J.A., Buddemeier R.W., Gattuso J.P., 2001, The future of coral reefs in an age of global change. Int. J. Earth Sci. 90, 426-437.

Knap A.H., Sleeter T.D., Dodge R.E., Wyers S.C., Frith H.E., Smith S.R., 1983, The effects of oil spills and dispersant use on corals. Oil Petrochem. Pollut. 1, 157-169.

Knutson T.R., Tuleya R.E., Kurihara Y., 1998, Simulated increase of hurricane intensities in a CO_2 warmed climate. Science 279, 1018-1019.

Kojis B.L., Quinn N.J., 2001, The importance of regional differences in hard coral recruitment rates for determining the need for coral restoration. Bull. Mar. Sc. 69, 967-974.

Laist D.W., 1987, Overview of the biological effects of lost and discarced plastic debris in the marine environment. Mar. Pollut. Bull. 18, 319-326.

Lewis J.B., 1971, Effects of crude oil and oil spill dispersant on reef corals. Mar. Pollut. Bull. 2, 59-62.

Lewis A.R., 1997, Effects of experimental coral disturbance on the structure of fish community on large patch reefs. Mar. Ecol. Prog. Ser. 161, 37-50.

Lewis A.R., 1998, Effects of experimental coral disturbance on the population dynamic of fishes on large patch reefs. J. Exp. Mar. Biol. Ecol. 230, 91-110.

Liddle M.J., Kay A.M., 1987, Resistance, survival and recovery of trampled coral on the Great Barrier Reef. Biol. Conserv. 42, 1-18.

Littler M.M., Littler D.S., 1999, Disturbances due to cyclone Gavin parallel those caused by a ship grounding. Coral Reefs 18, 146.

Loya Y., 1976, Recolonization of Red Sea corals affected by natural catastrophes and man-made perturbations. Ecology 57, 278-289.

Loya Y., Rinkevitch B., 1980, Effects of oil pollution on coral reef communities. Mar. Ecol. Prog. Ser. 3, 167-180.

Loya Y., Rinkevitch B., 1987, Effects of petroleum hydrocarbons on corals. In: Salvat B (Ed.), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 91-102.

Luckhurst B., Luckhurst K., 1978, Diurnal space utilization in coral reef communities. Mar. Biol. 49, 325-332.

Marszaleck D.S., 1981a, Sewage and eutrophication. In: Salvat B. (Ed.), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 77-90.

Marszaleck D.S., 1981b, Impact of dredging on a subtropical reef community, southeast Florida, USA. Proc. 4th Int. Coral Reef Symp. 1, 147-153.

McAllister D.E., 1988, Environmental, economic and social costs of coral reef destruction in the Philippines. Galaxea 7, 161-178.

McManus J.W., Nanola C.L., Reyes, R.B., 1997, Effects of some destructive fishing methods on coral cover and potential rates of recovery. Environ. Manage. 21, 69-78.

Meesters E.H., Bak R.P.M., 1993, Effects of coral bleaching on tissue regeneration potential and colony survival. Mar. Ecol. Prog. Ser. 96, 189-198.

Mergner H., 1981, Man-made influences on and natural changes in the settlement of the Aqaba reefs (Red Sea). Proc. 4th Int. Coral Reef Symp. 1, 193-207.

Moberg F., Folke C., 1999, Ecological goods and services of coral reef ecosystems. Ecol. Econ. 29, 215-233.

Morris D.W., 2003, Toward an ecological synthesis: a case for habitat selection. Oecologia 136: 1-13.

Mumby P.J., Chisholm J.R.M., Clark C.D., Hedley J.D., Jaubert J., 2001, A bird-eye view of the health of coral reefs. Nature 413, 36.

Munro J.L., Parrish J.D., Talbot F.H., 1987, The biological effects of intensive fishing upon coral reef communities. In: Salvat B. (Ed.), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 41-49.

Naim O., 1993, Seasonal responses of a fringing reef community to eutrophication (Reunion island, Western Indian Ocean). Mar. Ecol. Prog . Ser. 99, 307-315.

Naim O., Cuet P., Mangar V., 2000, Coral reefs of the Mascarene archipelago. In: McClanahan T.R., Sheppard C., Obura D.O. (Eds.), Coral reefs of the Indian Ocean: their Ecology and Conservation, Oxford University Press, pp. 353-381.

Neil D., 1990, Potential of corals stress due to sediment resuspension and deposition by reef walkers. Biol. Conserv. 52, 221-227.

Nugues M.M., Roberts C.M., 2003, Partial mortality in massive reef corals as an indicator of sediment stress on coral reefs. Mar. Pollut. Bull. 46, 314-323.

Nyström M., Folke C., Moberg F., 2000, Coral reef disturbance and resilience in a human-dominated environment. Trends Ecol. Evol. 413-417.

Nyström M., Folke C., 2001, Spatial resilience of coral reefs. Ecosystems 4, 406-417.

Obura D.O., 2005, Resilience and climate change: lessons from coral reefs and bleaching in the Western Indian Ocean. Estuar. Coast. Shelf Sci. 63, 353-372.

O'Neill R.V., Johnson A.R., King A.W., 1989, A hierarchical framework for the analysis of scale. Landscape Ecol. 3, 193-205.

O'Neill R.V., 2001, Is it time to bury the ecosystem concept? (with full military honors, of course!). Ecology 82, 3275–3284.

Öhman M.C., Rajasuriya A., Svensson S. 1998, The use of butterflyfishes (Chaetodontidae) as bio-indicators of habitat structure and human disturbance. Ambio 27, 708-716.

Palandro D., Andréfouët S., Dustan P., Muller-Karger F.E., 2003, Change detection in coral reef communities using the IKONOS sensor and historic aerial photographs. Int. J. Remote Sensing 24, 873-878.

Pastorok R.A, Bilyard G.R., 1985, Effects of sewage pollution on coral-reef communities. Mar. Ecol. Prog. Ser. 21, 175-189.

Pandofi J., Bradbury R., Sala E., Hughes T., Bjorndal K., Cooke R., McArdle D., McClenahan L., Newman M., Paredes G., Warner R., Jackson J., 2003, Global trajectories of long-term decline of coral reef ecosystems. Science 301, 955-958.

Pauly D.G., Silvestre G., Smith I.R., 1989, On development fisheries and dynamite: a brief review of tropical fisheries management. Nat. Res. Model. 3, 307-329.

Peyrot-Claussade M., Le Campion-Alsumard T., Harmelin-Vivien M., Romano JC., Chazotte V., Pari N., Le Campion J., 1995, La bioérosion dans le cycle des carbonates: essai de quantification des processus en Polynésie française. Bull. Soc. Géol. France 166, 85-94.

Pickett S.T.A., White P.S., 1985, Patch dynamics: a synthesis. In: Pickett, S.T.A., White, P.S. (Eds.), The ecology of natural disturbance and patch dynamics. Academic Press, New York, pp. 371-384.

Pickett S.T.A., Kolasa J., Armesto J.J., Collins S.L., 1989, The ecological concept of disturbance and its expression at various hierarchical levels. Oikos 54**,** 129-136.

Polunin N.V.C., Halim M.K., Kvalvagnaes K., 1983, Bali Barat: an Indonesian marine protected area and its resources. Biol. Conserv. 25, 171-191.

Porcher M., 1993, Intertropical coastal and coral reef areas and their development: practical guide, study methodologies, technical recommendations. Ministère de l'Environnement, Paris.

Quinn, J.F., Dunham A.E., 1993, On hypothesis testing in ecology and evolution. Am. Nat. 122, 602-617.

Randall J.E., 1987, Collecting reef fishes for aquaria. In: Salvat B (ed) Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 29-39.

Rapport D.J., Regier H.A., Hutchinson T.C., 1985, Ecosystem behavior under stress. Am. Nat. 125, 617-640.

Ray C.G., 1988, Ecological diversity in coastal zones and oceans. In: Wilson E.O. (Ed.), Biodiversity, National Academic Press, Washington DC.

Reese E.S., 1981, Predation on corals by fishes of the family Chaetodontidae: implications for conservation and management of coral rreef ecosystems. Bull. Mar. Sci. 31, 594-604.

Reimer A.A., 1975, Effects of crude oil on corals. Mar. Pollut. Bull. 6, 39-43.

Richmond R.H., 1997, Reproduction and recruitment in corals: critical links in the persistence of reefs. Chapman and Hall, New York, pp. 175-197.

Riegl B., Luke K.E., 1998, Ecological parameters of dynamited reefs in the northern Red Sea and their relevance to reef rehabilitation. Mar. Pollut. Bull. 37, 488-498.

Riegl B., Velmirov B., 1991, How many damaged corals in Red Sea reef systems? A quantitative survey. Hydrobiologia 216-217, 249-256.

Rinkevitch B., 1995, Restoration strategy for coral reefs damaged by recreational activities: the use of sexual and asexual recruits. Restoration Ecol. 3, 241-251.

Rinkevitch B., Loya Y., 1989, Reproduction in regenerating colonies of the coral *Stylophora pistillata.* In: Spanier E., Steinberger Y., Luria M. (Eds.), Environmental quality and ecosystem stability. ISEQES, Jerusalem, pp. 257-265.

Risk M., 1972, Fish diversity on a coral reef in the Virgin Islands. Atoll Res. Bull. 153, 1-16.

Roberts C.M., Ormond R.F., 1987, Habitat complexity and coral reef diversity and abundance on Red Sea fringing reefs. Mar. Ecol. Prog. Ser. 41, 1-8.

Rogers S., Gilnack M., Fitz C., 1983, Monitoring of coral reefs with linear transects: a case storm damage. J. Exp. Mar. Biol. Ecol. 66, 285-300.

Rubec P.J., 1988, The need for conservation and management of Philippine coral reefs. Environ. Biol. 23, 141-154.

Saila S.B., Kocic V.L., Mac Manus J.W., 1993, Modelling the effects of destructive fishing practices on tropical coral reefs. Mar. Ecol. Prog. Ser. 94, 51-60.

Salvat B., 1987, Dredging in coral reefs. In: Salvat B. (Ed), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 166-184.

Salvat B., Vergonzanne G., Galzin R., Richard G., Chevalier J.P., Ricard M., Renaud-Mornant J., 1979, Conséquences écologiques des activités d'une zone d'extraction de sable corallien dans le lagon de Moorea (île de la Société, Polynésie Française). Cah. Indo-Pacif. 1, 83-126.

Salvat B., Chancerelle Y., Schrimm M., Morancy R., Porcher M., Aubanel A., 2002, Restauration d'une zone corallienne dégradée et implantation d'un jardin corallien à Bora Bora, Polynésie Française. Rev. Ecol. 9, 81-96.

Sano M., Shimuzu, M. Nose, Y., 1984, Changes in structure of coral reef fish communities by destruction of hermatypic corals: observational and experimental views. Pac. Sci. 38, 51-79.

Shepherd A.R., Warwick R.M., Clarke, R.D., Brown, B.E., 1992, An analysis of fish community responses to coral mining in the Maldives. Environ. Biol. Fish 33, 367-380.

Smith S.V., 1985, Coral reef calcification. In: Barnes D.J. (Ed.), Perspectives on coral reefs. Brian Clouston, A.C.T., Australia, pp. 240-247.

Stejskal I.V., 2000, Obtaining approvals for oil and gas projects in shallow water marine areas in western Australia using an environmental risk assessment framework. Spill Sci. Tech. Bull. 6, 69-76.

Thomason J., Roberts C.M., 1992, What is a healthy reef? Reef Encounter 11, 8-9.

Tilmant J.T., 1987, Impacts of recreational activities on coral reefs. In: Salvat B. (Ed.), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 195-214.

Tratalos J.A., Austin T.J., 2001, Impacts of recreational SCUBA diving on coral communities of the Caribbean island of Grand Cayman. Biol. Conserv. 102, 67-75.

Underwood A.J., Peterson C.H., 1988, Towards an ecological framework for investigating pollution. Mar. Ecol. Prog. Ser. 46, 227-234.

Van Veghel M.L., Bak R.P., 1994, Reproductive characteristics of the polymorphic Caribbean reef building coral *Monastrea annularis*. III. Reproduction in damaged and regenerating colonies. Mar. Ecol. Prog. Ser. 109, 229-233.

Veron J.E., 1986, Corals of Australia and the Indo-Pacific. Angus Robertson Publishers, Australia.

Veron J.E., 2000, Corals of the world. Australian Inst Mar Sci, Townsville, Australia.

Ward S., Harrison P., 2000, Changes in gametogenesis and fecundity of acroporid corals that were exposed to elevated nitrogen and phosphorus during the ENCORE experiment. J. Exp. Mar. Biol. Ecol. 246, 179-221.

Wells S.M., Alcala A.C., 1987, Collecting of corals and shells. In: Salvat, B. (Ed.), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 13-27.

White A.T., 1987, Effects of construction activity on coral reef and lagoon systems. In: Salvat B. (Ed.), Human impacts on coral reefs: facts and recommendations. Antenne Museum EPHE, French Polynesia, pp. 185-193.

White T.J., Fouda M.M, Rajasuriya A., 1997, Status of reefs in south Asia, Indian Ocean and Middle East seas (Red Sea and Persian Gulf). Proc. 8th Int. Coral Reef Symp. 1, 301-306.

Williams D.M. 1986, Temporal variation in the structure of reef slope fish communities (central Great Barrier Reef): Short-term effects of *Acanthaster planci* infestation. Mar. Ecol. Prog. Ser. 28, 157-164.

Williams I.D., Polunin N.V.C., 2000, Differences between protected and unprotected Caribbean reefs in attributes preferred by dive tourists. Environ. Conserv. 27, 382-391.

Wolanski E., Pickard G.L., Ripp D.L., 1984, River plumes, coral reefs and mixing in the Gulf of Papua and the northern Great Barrier Reef. Estuar. Coast. Shelf Sci. 18, 291-314.

Woodland D.J., Hooper J.N.A., 1977, The effect of trampling on coral reefs. Biol. Conserv. 11, 1-4.

Yamano H., Tamura M., Kunii Y., Hidaka M., 2003, Spectral reflectance as a potential tool for detecting stressed corals. Galaxea 5, 1-10.

Zakai D., Levy O., Chadwick-Furman N.E., 2000, Experimental fragmentation reduces sexual reproductive output by reef-building coral *Pocillopora damicornis*. Coral Reefs 19, 185-188.

Zakai D., Chadwick-Furman N.E., 2002, Impacts of intensive recreational diving on reef corals at Eilat, northern Red Sea. Biol. Conserv. 105, 179-187.

NOAA Web Update May 4, 2010
DEEPWATER HORIZON Incident

Situation – Tuesday 04 May – As the weather became better throughout the day, skimming, boom placement, aerial application of dispersants, imaging of the oil plume, in situ burning and observation overflights all took place in an effort to handle the oil leaking from the Deepwater Horizon Incident.

Remotely Operated Vehicles (ROVs) cut off a section at the end of the riser pipe, which used to lead from the well to the rig, and capped it with a valve. While this stopped one of the three leaks, oil continues to enter the Gulf of Mexico at a rate of approximately 5000 barrels (210,000 gallons) per day. Testing of a new technique that involves injecting dispersants at the oil's source - 5000' below the surface - will require further monitoring to tell whether the sub-sea dispersants are having an effect and further analysis to ensure effects in the water column are not worse than those from oil. If successful, the technique could reduce or prevent an oil plume from forming at the surface. Drilling of a relief or cut-off well got further, but will take several months to stop the flow. The first collection dome, a large cofferdam-like structure that collects oil at the sea floor and funnels it for collection at the surface, was deployed today. These containment chambers have never been tried this deep - 5000' - and will take about a week to be fully rigged and functional. Hundreds of thousands of feet of boom have been deployed to contain the spill, with hundreds of thousands more staged and ready to be deployed.

NOAA efforts have included: modeling the trajectory and extent of the oil, getting pre-impact samples surveys and baseline measurements, planning for open water and shoreline remediation, supporting the Unified Command as it analyzes new techniques for handling the spill and starting Natural Resource Damage Assessments (NRDA).

- Decreasing wind and sea state should allow the full spectrum of surface operations until the weekend. NOAA's National Weather Service has created a special forecast for the incident area which you can access here: http://www.srh.noaa.gov/lix/
- NOAA has 3 aircraft on-scene: a King Air specially equipped for photogrammetry and 2 Twin Otter aircraft one for marine mammal observations
- The Coast Guard is using forecasts and graphics of oil movement prepared by NOAA's Emergency Response Division (ERD) and Marine Charting Division to keep mariners out of oil areas by depicting them on electronic charts.
- NOAA restricted fishing in federal waters of the Gulf of Mexico directly adjacent to the area closures enacted by Louisiana. The closure, which will be in effect for at least 10 days, is to protect consumers and the seafood industry. NOAA fisheries representatives will be meeting with fishermen this week to assist them. Further details can be found here: http://sero.nmfs.noaa.gov/.

A Quick Explanation of NRDA for Deep and Shallow Water Corals
Injured by the Deepwater Horizon Incident

John Cubit, NOAA/ARD

19 May 2010

Draft Not for citation. Please send comments/changes to John.Cubit@noaa.gov

Introduction

BP is responsible for restoring to baseline the corals and other natural resources "injured" by the Deepwater Horizon incident. We calculate the required amount of coral restoration based on the ***quantified losses*** of corals. We use the natural resource damage assessment (NRDA) process to do the ***quantification*** of coral loss ***caused*** by the incident. If a study cannot produce the answer of how many corals and/or coral services were lost because of the Deepwater Horizon incident, it will have little utility in our NRDA process.

"Quantification" of coral loss and ***"cause"*** of the loss are highlighted here to emphasize their critical importance in NRDAs that are defensible in scientific peer-reviews, heavy-duty negotiations, and litigation. Stop. Recognize that merely detecting an effect on corals is not the same as *quantified loss* of corals and/or coral services in an NRDA. In designing an NRDA, continuously ask the question, "How much coral restoration and what kinds of restoration will this NRDA demonstrate as being needed?" If the NRDA does not inventory the total numbers, sizes, and species of coral colonies lost, or coral services lost, how can you defensibly demonstrate to peer reviewers, BP, or a court what kinds and scales of restoration BP is responsible for providing?

What is "injury"? In the case of the coral resources, "injury" in the Deepwater Horizon is incident includes any losses of the coral colonies themselves, or loss of any services or ecological functions provided by the corals, including acute mortality, reduced long-term survivorship, reduced growth, diminished reproductive output, harmed viewing value for divers, etc.

What is "baseline" in NRDA? For NRDA, "baseline" is defined as the condition of the resource that would have existed if the incident in question had not occurred. Contrary to what you may have heard, NRDA baseline is not necessarily a flat line and is not necessarily the average condition of the resources before the incident.

Understanding NRDA baseline is particularly important for coral populations in the Gulf and Caribbean, where large-scale and rapid changes in baseline have been documented in certain locations. In some locations, certain corals are going extinct, meaning baseline is declining. In some locations, Florida corals are impacted by cold water and hot water events, causing fluctuations in baseline. Where successful coral restoration projects or habitat protection projects are underway, baseline for corals may be increasing. Developing a rational baseline for *specific* locations is part of the NRDA process.

What qualifies as "incident-caused" injury? "Causes" in this case include any aspect of the Deepwater Horizon incident that produces coral injury, including the physical smothering and/or chemical toxicity of the discharged oil, toxicity of dispersants, mechanical impacts of clean-up equipment, scraping of corals by oil sorbent or containment booms, trampling by clean-up crews, groundings of response boats, etc.

Conducting NRDAs for corals potentially impacted by the Deepwater Horizon Incident

This is a summary conducting NRDAs for corals in this case. ***Note that use of exposure gradients or impact vs control comparisons are essential to separate injuries caused by the Deepwater Horizon incident from injuries caused by other factors.***

Resource losses. A NRDA procedure for corals will quantify the loss of corals and/or coral services and determine the cause(s) of the loss(es). This is generally accomplished (1) by comparing amounts of coral loss over a spatial gradient of exposure to oil/dispersants, or (2) comparing amounts of loss between oiled impact and non-oiled reference sites. Such comparisons can be made more powerful (logically and statistically) by including before-and-after data for the conditions of the corals at both the impact and reference sites. ("BACI" [before-after-control-impact] survey designs and statistical analyses are well developed for impact assessments.) *This use of spatial gradients and reference sites ("controls") is a way of eliminating the impacts of potential confounding factors, such as cold- and hot-water events in the Keys, which are present over the gradient and present at the reference sites as well.*

Causation. In this case, determination of oil and/or dispersants as being direct causal factors for claimed coral injury requires evidence that the corals were exposed to these substances coming from the Deepwater Horizon incident. This can be done by tracking the oil/dispersant from the Deepwater Horizon to the injury site and/or documenting the presence of unique Deepwater Horizon oil at the injury site (e.g., by "finger-printing" samples of oil in sediments, water, or tissue samples from biota at the site). Contrary to assertions from some toxicologists, the oil/dispersants ***do not have to be dissolved in the water to have toxic effects on the corals.*** For example, corals can ingest undissolved oil from the water column or undissolved oil that is in or on ingested food. In other words, water samples are not required to document exposure of biota to oil at a site.

Injuries attributed to clean-up actions also need to be quantified and compared with reference sites. For example, physical injury to corals caused by booms, tow-lines, small boats, trampling, etc., can be documented by photographing these activities combined with photos or other surveys of freshly abraded and broken corals at these same locations. (Use GPS markers, landmarks, and photo scales where possible.) Similar surveys for to quantify similarly injured corals need to be repeated at reference sites to rule out the impacts of storms, floating debris, and other factors that could cause the same kind of injury to corals.

Sampling layouts and other design aspects for field quantification of coral injury

Sampling designs must provide scientifically defensible data to represent the area of claimed injury. This issue is too detailed for this summary document. If this topic is outside your expertise, work with a good quantitative ecologist and statistician to develop your scientifically and statistically defensible NRDA survey procedure. Some of your choices in this regard may be directed by the need to match your new data with pre-incident data for your assessment sites. The contractor IEc has provided a statistician to advise the Trustees on these matters.

The Bottom Line: Habitat Equivalency Analysis (HEA) and restoration quantification

NRDAs frequently use HEA (or Resource Equivalency Analysis) as the accounting method to sum up the losses of natural resources and to convert these losses into scaling for restoration projects. In contrast to other resource accounting methods, HEA includes *duration* of loss. For example, loss of a 50 year old *Acropora palmata* colony will represent a much greater loss of coral-formed habitat than the loss of an equivalent area of one-year old *A. palmata*. For this reason, NOAA NRDAs for corals now measure the abundance of corals by using counts of coral colonies by species and size categories, instead of the older measure of areal coverage (which measures all corals as if they were flat crusts).

Work with your NRDA professional to ensure that the data you collect will work as inputs for HEA.

NOAA Web Update May 2, 2010
DEEPWATER HORIZON Incident

Situation – Sunday 02 May – Today NOAA restricted fishing in federal waters of the Gulf of Mexico threatened by the BP oil spill - from the mouth of the Mississippi to Pensacola Bay (***click here for map***). The closure, which will be in effect for at least 10 days, is to protect consumers and the seafood industry. Secretary of Commerce Gary Locke said, "We stand with America's fisherman, their families and businesses in impacted coastal communities during this very challenging time. Fishing is vital to our economy and our quality of life and we will work tirelessly protect to it". NOAA is part of the Department of Commerce. Support came from Harlon Pearce, Chairman, Louisiana Seafood Promotion and Marketing Board and Ewell Smith, Executive Director, Louisiana Seafood Board who said, "We Support NOAA's precautionary closure of the affected area so that the American consumer has confidence that the seafood they eat is safe. It is also very important to underscore the fact that this closure is only the affected area of the Gulf of Mexico, not the entire Gulf. The state waters of Louisiana west of the Mississippi River are still open and the seafood coming from that area is safe." Further details can be found here: http://sero.nmfs.noaa.gov/.

The state of Louisiana has already closed vulnerable fisheries in state waters – within 3 miles of the coast. NOAA is closing areas directly adjacent to the area closures enacted by Louisiana, and is working with state governors to evaluate the need to declare a fisheries disaster, which would facilitate federal aid to fishermen. NOAA fisheries representatives will be meeting with fishermen this week to assist them, and BP will be hiring fishermen to help clean up and deploy boom in the Gulf of Mexico.

President Obama was on-scene today getting a first-hand look at the spill, which is still leaking at a rate of approximately 5000 barrels (210,000 gallons) per day from three damaged sections of piping on the sea floor. Engineers are working to inject dispersants at the oil's source - 5000' below the surface. If successful, it could reduce or prevent an oil plume from forming at the surface. Drilling of a relief or cut-off well started today, but it will take several months to stop the flow. Work also continues on a collection dome at the sea floor; this technique has never been tried at 5000'. Very high winds and rough seas curtailed surface operations, such as skimming and applying dispersant by aircraft. Hundreds of thousands of feet of boom have been deployed to contain the spill, with hundreds of thousands more staged and ready to be deployed.

NOAA efforts have included: modeling the trajectory and extent of the oil, getting pre-impact samples surveys and baseline measurements, planning for open water and shoreline remediation, supporting the Unified Command as it analyzes new techniques for handling the spill and starting Natural Resource Damage Assessments (NRDA).

- NOAA's National Weather Service displayed radar data at central command today so the command could see where thunderstorm activity was moving and receive warnings immediately.
- A forecast decrease in winds should allow the full spectrum of surface

operations starting tomorrow.

- NOAA's Emergency Response Division (ERD) creates the oil trajectories that response planners rely on.
- The Coast Guard is using forecasts and graphics of oil movement prepared by NOAA's Emergency Response Division (ERD) and Marine Charting Division to keep mariners out of oil areas by depicting them on electronic charts.
- NOAA's Assessment and Restoration Division (ARD) completed additional baseline sampling in Gulf Islands National Seashore in conjunction with NOAA Restoration Center, National Park Service and Florida Department of Environmental Protection staff.
- Natural resource economists from ARD also drafted plans to systematically survey recreational users along the Gulf Coast about their use of areas affected by the spill.

To report oil on land, or for general Community and Volunteer Information, please call 1-866-448-5816.

To report oiled or injured wildlife, please call 1-800-557-1401.

BP is asking fishermen for their assistance in cleaning up the oil spill. BP is calling this the Vessel of Opportunities Program and through it, BP is looking to contract shrimp boats, oyster boats and other vessels for hire to deploy boom in the Gulf of Mexico. Fishermen should call 425-745-8017 about this program.

NOAA Roles: NOAA is a vital part of the massive response effort on the Deepwater Horizon incident. Many personnel are on scene and many more are engaged remotely, as follows:

Office of Response and Restoration (OR&R)

- Scientific support to the U.S. Coast Guard and Unified Command

Emergency Response Division (ERD)

- Predict where the oil is going and its effects
- Overflight observations and mapping
- Identify resources at risk
- Predict fate (chemical changes) of oil
- Recommend appropriate clean-up methods
- Manage data and information

Assessment and Restoration Division (ARD)

- Plan for assessment of injuries to natural resources
- Coordinate with state and federal trustees
- Implement sampling plans

National Weather Service

- Incident weather forecasts including marine and aviation

National Environmental Satellite, Data, and Information Service (NESDIS)

- Experimental imagery for spill trajectory forecasts

National Marine Fisheries Service (NMFS)

- Issues related to marine mammals, sea turtles, and fishery resources
- Management of Fishery Closures
- Public Affairs support to the Joint Information Center

Office of Marine and Aviation Operations (OMAO)

- USCG Liaison to the DCO Incident Support Team USCG Headquarters

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Autopsy of an Oil Spill
Author(s): Linda Garmon
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Published by: Society for Science & the Public
Stable URL: http://www.jstor.org/stable/3965303

Autopsy of an Oil Spill


R&D Mexico

Researchers hope that data gathered from the ongoing, detailed analysis of the Ixtoc I oil well blowout will minimize the impact of future oil spills

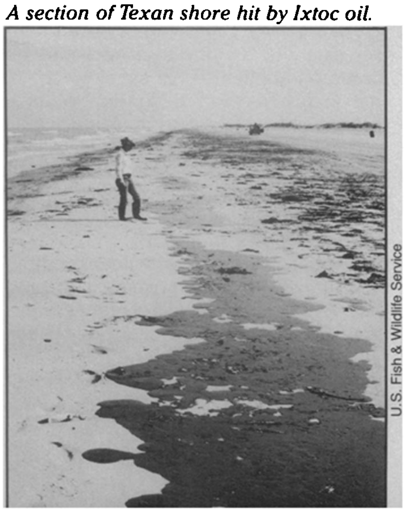
BY LINDA GARMON

Nearly three months had passed since the last observed tar ball washed onto Padre Island beaches north of Port Mansfield, Tex. More than a year had passed since the first oiled bird, a blue-faced booby, was found and brought to the island's cleaning station. "Much media attention was given to the first oiled bird," a U.S. Coast Guard on-scene coordinator wrote in the official activity report.

But this day's activity would pass with barely a notice. It was Oct. 1, 1980, and Captain Gerald Hinson had decided to terminate the USCG clean-up efforts in response to Ixtoc I, the Mexican oil well that nearly 16 months before had blown out in the Bay of Campeche, spilling 140 million gallons of oil into the Gulf of Mexico (SN: 12/15/79, p. 405).

For the USCG response team, Ixtoc I is over. But Ixtoc has left behind a legacy that is very much alive in both the scientific and political arenas of the United States and Mexico. "The Ixtoc I is important…as a case study for researchers, policy makers and response teams," says Richard S. Golob, director of the Center for Short-Lived Phenomena in Cambridge, Mass. "The incident has major implications for open-ocean spill response, blowout prevention technology, international pollution damage compensation, scientific spill research and outer continental shelf development [for oil and gas exploration]." Researchers are just now piecing together the complex Ixtoc I puzzle in an effort to address such issues.

A section of Texan shore hit by Ixtoc oil.


U.S. Fish & Wildlife Service

The first piece to that puzzle was molded by the events leading up to the June 3, 1979, blowout of the Ixtoc I, a Petroleos Mexicanos (PEMEX) exploratory well about 50 miles offshore from Ciudad del Carmen. By June, Ixtoc was drilling at a depth of about 11,800 feet below the seafloor with a bit screwed to the bottom of drill collars (a thick-walled pipe) suspended from the drilling rig by the drill pipe (a thin-walled pipe). Drilling fluid, commonly known as "drilling mud," was being pumped from surface mud tanks down the inside of the drill pipe, continuing down the drill collars and out through the bit. The mud then flowed up the annulus — the area between the outside of the pipes and the inside of the casing, or hole — and returned to the surface mud tanks.

Circulating drilling mud—composed of water, clay and certain chemicals—lubricates the drill bit, carries rock cuttings out of the hole and provides a column of fluid in the hole, the weight of which counterbalances potential pressure formations. The day before Ixtoc blew, the drill bit hit a pocket, or region of soft strata, and the valuable circulation was lost. This meant that rather than returning to the surface, the drilling fluid was escaping into fractures in the rock at the bottom of the hole. PEMEX officials decided to remove the bit, run the drill pipe back into the hole and pump materials down this open-ended drill pipe in an effort to seal off the fractures causing the loss of circulation.

During this pipe-removal operation, though, drilling mud suddenly began to flow, with rapidly increasing pressure and speed, up both the annulus and the inside of the drill pipe. Normally, this dangerous flow can be stopped by activating the shear rams of the blowout preventer (BOP) to sever and seal off the drill pipe. But the Ixtoc pipe removal operations had brought the drill collars in line with the BOP at the time of the mud flow. The BOP rams simply were not designed to sever the thick steel walls of the drill collars, so the flow continued.

Eventually, the mudflow was followed by a gush of oil and gas at an ever-increasing rate. The oil and gas fumes exploded on contact with the operating pump motors, a fire broke out and the drilling tower collapsed, causing damage to underlying well structures.

Thus began the largest oil spill in world history. Within one week, Ixtoc I had lost more oil than the December 1976 *Argo Merchant* spill of 7.6 million gallons off the Massachusetts coast; by late July, Ixtoc surpassed the 68 million gallons of oil that the tanker *Amoco Cadiz* spilled off Brittany, France, in March of 1978.

Ixtoc's record-breaking gush gave scientists the opportunity to brush up on oil-spill behavior. When oil is released into the environment, it is weathered by one of five processes: evaporation into the atmosphere, dissolution into the water, emulsification (formation of an oil-and-water emulsion called "chocolate mousse"), degradation by microorganisms or photochemical oxidation by sunlight and atmospheric oxygen. To study this weathering phenomenon, a team of National Oceanic and Atmospheric Administration scientists boarded the NOAA ship *Researcher* and sampled ocean water, oil, bottom sediments and organisms within a few hundred feet of the burning well. The NOAA team then sampled the oil during its long journey north toward the Texas coast to study how weathering would affect the Gulf-water distribution of the various hydrocarbon components in the Ixtoc oil.

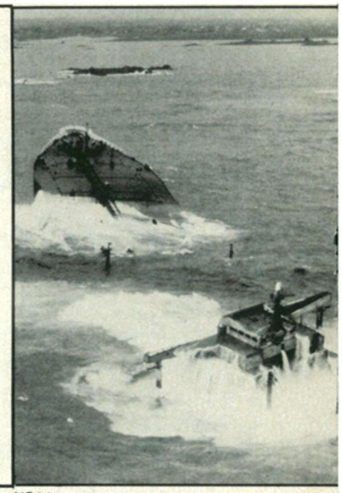
The result of that voyage is a "significant contribution" to the understanding of oil

R&D Mexico

The table (center) summarizes some of the differences between the oil spills resulting from the wreckage of the Amoco Cadiz *(right) and the blowout of the Ixtoc I well (left).*

	Oil spill	AMOCO CADIZ	IXTOC-I
	Nature of incident	stranding of a tanker	blowout (drilling well)
	Location	Brittany coast, PORTSALL (France)	Gulf of Mexico (Mexico) 19°24.5′ N-92°12.6′ W
	Date	3/16/78	6/3/79 to 3/20/80
	Crude oils	"Arabian Light" & "Iranian Light" (about 1:1)	Ixtoc-I
	Quantities discharged	223,000 t.	~ 600,000 t.
	Density	0.85	0.84
Chemical Composition	Saturated	39% /1/	50% /3/
	Aromatics	34%	32%
	Resins & Asphaltens	27%	18%
	Nickel	14 ppm /2/	10.5 ppm
	Vanadium	45 ppm	55 ppm

Michel Marchand et al. CIRES, Boulder, Colo.

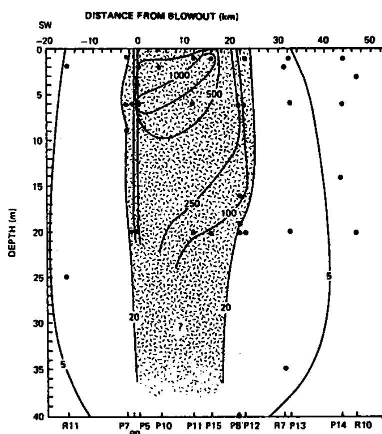


NOAA

behavior, says Donald Atwood, chief scientist onboard the *Researcher*. The ship's team discovered, for example, that photochemical oxidation plays a key role in transforming oil droplets into mousse. Prior to the Ixtoc expedition, scientists believed that mousse forms as soon as oil enters the water. The NOAA study indicates, however, that mousse does not form until the oil is three to 15 nautical miles from the well and that its formation is driven largely by photo-oxidation. "Sunlight drastically altered the oil," Atwood says. "It caused the hydrocarbon to lose some carbon atoms and take up some oxygen atoms, so that the oil became chemically more like soap and could emulsify." Photo-oxidation also appeared to alter the toxicity of the oil, making it more toxic in some cases and less in others.

Other *Researcher* findings include the observation that the oil-"eating" microbial populations within about 25 miles of the well head rapidly increased in size and that these microbes, like sunlight, promote mousse formation. In addition, the NOAA researchers found that the microbial degradation of oil was limited by the amount of nutrients — particularly nitrogen and phosphates — in the water.

But the finest feather in *Researcher*'s cap may represent the work of Paul D. Boehm and David L. Fiest of Energy Resources Co. Inc. At the recent American Chemical Society meeting in Las Vegas, Nev., these researchers presented their preliminary, though nonetheless significant, findings based on the series of water samples taken aboard the *Researcher* as it moved along the axis of Ixtoc's surface slick: a map contouring the subsurface concentrations of petroleum. This oil spill map, the first of its kind, indicates the concentrations of petroleum at particular ocean depths and at specific distances from the Ixtoc blowout. Such an avant garde oil spill characterization is important because "the fate of components of spilled oil … [is] closely linked to the biological impact of these pollutants," Boehm and Fiest explain. The researchers attribute their success to the use of synchronous scan spectrofluorometry — an analytical device that identifies the component concentrations in a sample by the tell-tale fluorescence emissions after exposure to ultraviolet light.



Boehm and Fiest

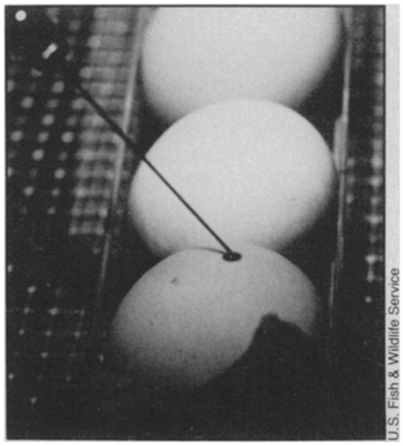
Concentration contours of Ixtoc oil.

The contour map study was one of 12 presentations at the ACS meeting included in a special oil spill symposium. Several other of those presentations looked at methods of "fingerprinting," or identifying the source of an oil pollutant. Crude oil is an extremely complex mixture of hydrocarbon compounds made up predominately of hydrogen and carbon but also containing traces of sulfur, nitrogen and oxygen. All oils are composed of the same types of hydrocarbon compounds and differ only in often-subtle component quantities. Further blurring the picture of pollutant origin is the fact that marine oil can come from several different sources: In addition to oil spills, routine tanker traffic, natural seepage and land runoffs dump petroleum into the ocean.

And therein lies a major challenge for oil spill analyzers. To draw an accurate picture of the fate of runaway oil, researchers first must be able to confirm that the oil slicks they are tracing in the ocean currents, the tar balls they are observing on shores or the petroleum concentrations they are extracting from marine organisms are from the suspected source. During the ACS oil spill symposium, I. R. DeLeon and colleagues of the Center for Bio-Organic Studies in New Orleans, La., suggested that the azaarene (nitrogen-containing aromatics, or ringed hydrocarbons) content in oil samples "may serve as useful passive tags for tracing petroleum sources in the marine environment." Analyzing oil for its azaarene content seemed particularly appropriate for Campeche Bay: While these compounds generally are present in oil in very small amounts, they are found at slightly higher concentrations in Ixtoc oil. Azaarene content also is of interest because certain of these compounds are known carcinogens.

Aromatic hydrocarbons, such as the azaarenes, usually are found to be more toxic than the non-ringed, or aliphatic, hydrocarbons of oil. Researchers at the Patuxent Wildlife Research Center in Laurel, Md., recently lent further credence to this canon of petroleum toxicity in their studies of the effects of oil on the hatchability of aquatic bird eggs. Small quantities of oil applied to the eggs of aquatic birds in the laboratory caused embryo mortality. For example, as little as 5 microliters of crude oil applied to the shell surface on the eighth day of incubation reduced hatching of mallard eggs by as much as 90 percent. But when the shell surfaces were coated with as much as 50 microliters of an aliphatic-only mixture, embryos did not die.

The results of studies of the effect of oil ingestion on the physiological condition and survival of birds were more encouraging. The Patuxent researchers were particularly interested in determining how two endangered species — the peregrine falcon and the whooping crane — would fare when Ixtoc oil reached their coastal



Studies show that the toxicity of the oil, rather than blocking of the shell's "breathing" pores, is what kills embryo mallards.

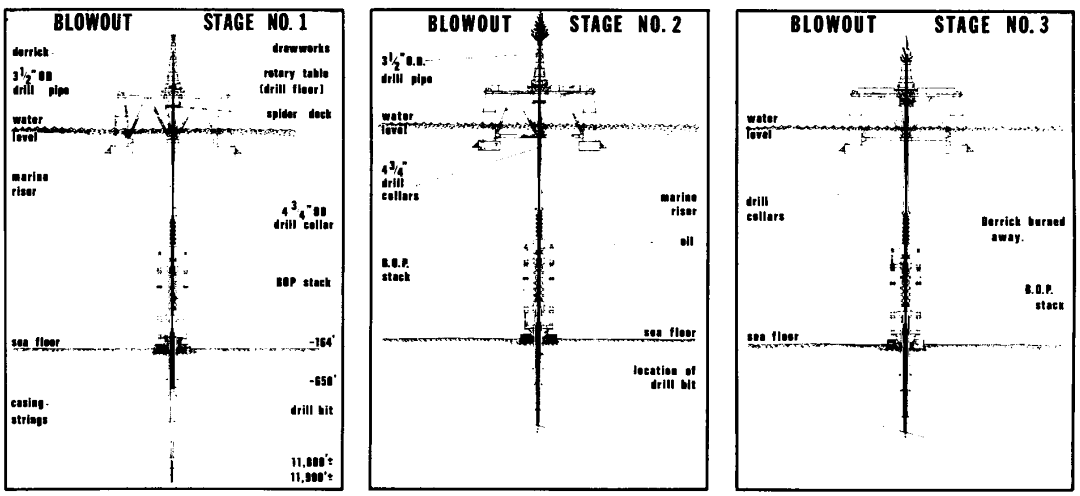
habitats and covered their food supplies. Under the direction of Lucille F. Stickel, the Patuxent bird watchers studied the effect of oil ingestion on endangered species surrogates — kestrels for the falcons and sandhill cranes for the whooping cranes. Although data collected from these studies still are preliminary, it appears that adult birds could survive spill levels of petroleum hydrocarbons in their diet when not otherwise stressed.

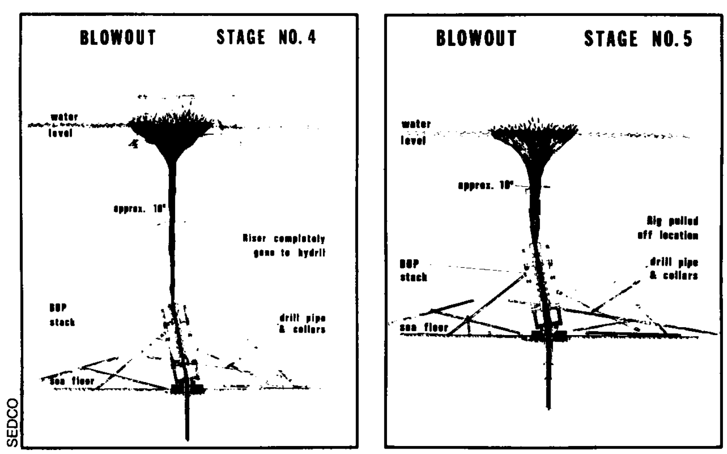
But the final test never came. By the time the first cranes arrived about a year ago at their wintering areas in the Aransas National Wildlife Refuge north of Port Aransas, Tex., the current flow along the Texas coast had reversed, carrying the oil south. No oil reached the refuge. Moreover, prior to the current reversal, only about 20 Texas coast birds were known to have died as a result of direct oiling.

The impact of the Ixtoc spill on other wildlife, such as turtles and fish, is still being evaluated. Turtle authorities first sensed trouble for the endangered Atlantic Ridley sea turtles this summer when scientists fed their latest data on Gulf currents and oil patch locations into a computer model, developed by NOAA and USCG researchers, that simulates the trajectory of pollutants in the ocean. The spill trajectory model, based on studies of previous spills, predicted that the Ixtoc oil probably would affect the Mexican coast between Tampico and Lower Laguna Madre in July, threatening the Ridley sea turtles that breed along a stretch of beach near Rancho Nuevo, Mexico. The Ridley eggs usually begin hatching in mid-June and turtles continue to emerge until mid-August. The hatchlings then swim west and north in the Gulf waters for about two months. Experts, fearing that these young turtles might ingest the Ixtoc oil during their premiere swim, organized a turtle airlift that carried about 9,000 turtles to a patch of sargassum less than 25 kilometers offshore.

Whether the turtle airlift saved the Ridley population from fatal oil spill encounters remains to be seen. According to U.S. Fish and Wildlife officials, if the population of adults next spring is fewer than 1,500 — which would be the lowest recorded population in recent years — then turtle authorities probably could assume that at least the adults met with the oil slick. It will take about eight years, however, before the impact of the Ixtoc blowout on this year's hatchlings can be evaluated; at that time, the hatchlings will have matured and returned home to Rancho Nuevo.

As with the Ridley hatchlings, the overall environmental impact of Ixtoc will take years to evaluate. Still, some researchers already say the Gulf of Mexico seems back





The drawings of the Ixtoc I well depict the chain of events that occurred in the Bay of Campeche from June 3 to July 12, 1979. Shortly after the pipe-removal operation had situated the thicker-walled drill collars in line with the BOP stack (Stage 1), drilling mud began to flow up the annulus and also out of the inside of the drilling pipe (Stage 2). Oil and gas followed the mud flow, and fire broke out (Stage 3). Underlying support structures collapsed (Stage 4), and the floating rig was pulled off location (Stage 5).

to normal. "If you go to the beaches of South Padre Island today," said ACS oil spill symposium participant Edward B. Overton, "you'll find good swimming and good fishing." Although it looks like "the end of the world" on the beaches during an oil spill, "The environment springs back," says Overton of the Center for Bio-Organic Studies. "In some people's minds, it's as though we create a sterile area after we've had a spill. This is not the case."

Other researchers do not share Overton's optimism. Some believe, for example, that the 37 tar mats, or areas of buried oil, in the subtidal region off the coast of Texas may present a continuing pollution problem. These mats reportedly measure about 60 meters long and 6 meters wide.

In addition, "Scientists still have not been able to account for the bulk of the 140 million gallons of oil that spilled from the Ixtoc I and that, according to NOAA, had covered up to 10 percent of the surface area of the Gulf of Mexico in the fall of 1979," Golob reported at the ACS meeting. Golob says that PEMEX unsuccessfully used a variety of cleanup techniques, including skimmers, dispersants and the Sombrero oil collection device — a 300-ton octagonal steel cone similar in shape to a Mexican hat — to recover the spilled oil. Even though local storms and hurricanes were in part to blame for the overall failure of these techniques, Golob says, "If the Mexicans — with equipment from the best manufacturers and expertise from the finest spill experts worldwide — were not able to deal with the Ixtoc I spill, then the cleanup problems encountered ... raise questions about the adequacy of existing equipment and technology to meet the demands of any massive open-ocean spill, whether from a well blowout or a tanker stranding."

Golob says Ixtoc I analyzers should address not only those issues concerning blowout prevention and cleanup technologies, but also the political questions, such as compensation for damages from a transboundary incident.

These issues were discussed last December during the Senate hearing on the Campeche oil spill. The hearings were particularly timely because in just 13 days the U.S. Department of Interior intended to hold the first lease sale for marine oil and gas activities on Georges Bank — an area off the New England coast considered to be the world's most productive fishing ground and thought to contain only 3.4 percent of the oil and 4.4 percent of the gas recoverable from the Outer Continental Shelf. When the sale proceeded as scheduled, following the Dec. 11, 1979, lease sale of a similarly controversial tract off the coast of Alaska, groups that oppose rapid development of offshore drilling feared that Ixtoc already had left the political arena — months before the well was capped.

Overton, though, says that while an increase in ocean drilling, and therefore future accidental inputs of fossil fuels in the marine environment, is inevitable, "We learned from the *Amoco Cadiz* spill, we are learning from the Ixtoc I spill and we will learn from future spills. This is an ongoing study.... We have not forgotten Ixtoc." □

Mussel-bound monitors

Where the ocean meets the shore is a dynamic environment highly susceptible to society's discards — fossil fuels, trace metals, halogenated hydrocarbons and radionuclides. Researchers recognizing the increasing threat to this precious environment have organized "Mussel Watch," a systematic and continuing program for monitoring coastal contaminants.

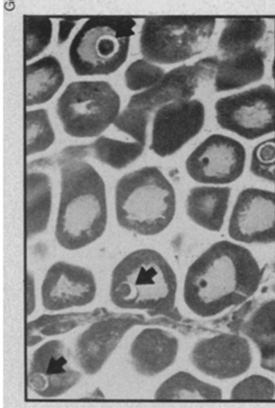
Mussel Watch is a strategy of using bivalves — mussels, oysters and clams — as vigilantes of marine pollutants. The program involves periodically analyzing tissues of bivalves from specific Mussel Watch stations to identify areas of elevated contamination and to provide baseline data from which future hot spots can be identified. As a routine part of the program, for example, oyster samples were taken from the shores of Port Aransas, Tex., before the Ixtoc I exploratory well blew out in June of 1979 and began spewing oil into the Gulf of Mexico. With this pre-Ixtoc baseline data in hand, mussel watchers on the Texas coast recently began analyses of post-Ixtoc oyster samples for fossil fuel compounds to aid in gauging the spill's impact.

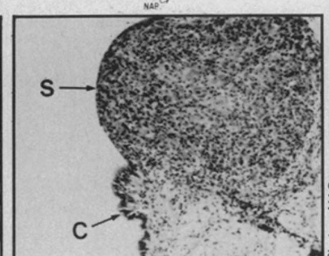
If elevated concentrations of fossil fuel compounds are discovered in these samples, however, mussel watchers must consider all possible sources of contamination. The National Academy of Sciences estimates that 6.11 million metric tons of petroleum enter the worldwide marine environment each year from sources such as natural seeps (.6 million metric tons per year), industrial and municipal wastes (.6), river runoff (1.6), urban runoff (.3) and offshore production and tanker traffic (2.21). Oiled oysters can flag a problem but not its origin.

Another limitation of the Mussel Watch program is the fact that many different variables — bivalve size, sex, reproductive state and physiological condition, for example — may influence the levels of pollutants accumulated by mussels. Such observations have stimulated work in the development of an "artificial mussel," such as one made with polyurethane foam "tissues." These synthetic, pollutant-concentrating tissues would not be influenced by nature's variables.

Despite the limitations, bivalves could easily be global pollutant barometers, says Mussel Watch participant John W. Farrington, because they are composed of "cosmopolitan species." Explains Farrington, of Woods Hole Oceanographic Institution in Massachusetts, "Mussels and oysters have cousins worldwide; the mussel you see on the East Coast is close to the one you see in the Mediterranean, which is close to the one you see on the West Coast." The similarity between species helps to standardize the program.

Goldberg et al. NAS





Photos: NAS

At U.S. Mussel Watch stations researchers find that bivalves subjected to pollutants are less susceptible to parasites (left) and can undergo digestive gland cell transformations (C to S above).

Evaluating the merit of a global Mussel Watch program was one concern of the recent NAS-sponsored International Mussel Watch Workshop in Barcelona, Spain. Now, a second Mussel Watch conference is in the works, and organizers hope to hold it in Southeast Asia to encourage input from Third World countries there. Farrington says this region could benefit from Mussel Watch not only because the program offers a relatively simple and inexpensive screen, or first-step, analysis for pollutants, but also because "a whole chunk of the world's population is living on the coast there."

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OIL POLLUTION ON CORAL REEFS: A REVIEW OF THE STATE OF KNOWLEDGE AND MANAGEMENT NEEDS

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OIL
CORALREEFS
POLLUTION
HYDROCARBONS
DISPERSANTS
CLEAN-UPMETHODS FOR OIL

ABSTRACT. – This paper reviews the current state of knowledge of the effects that oil pollution has on scleractinian corals. Areview of results obtained in laboratory as well as in field conditions are given and suitable management tools are discussed. Studies made in the 1970s and 1980s presented conflicting results regarding the impacts of oil on coral physiology, but later results confirmed the detrimental effect of oil on corals. The world's coral reefs are severely threatened by an array of factors, one of which is oil pollution. More laboratory and field work with current oils and dispersants is urgently needed in order to update our knowledge in this field and reduce impacts in case of a major oil spill on coral reefs.

Introduction

Coral reefs are the most diverse and complex communities in the marine environment. Hermatypic corals play a key role in forming the structure of coral reefs and providing substrate and shelter for a wide variety of organisms. Acute damage to corals may result in a collapse of this complex community.

Coral reefs are seriously threatened by human activities in most parts of the world. Globally, 20% of the world's coral reefs have been effectively destroyed and show no immediate prospects of recovery, approximately 40% of the 16% that were seriously damaged in the 1998 bleaching event are either recovering well or have recovered. It is predicted that 24% of the world's reefs are under imminent risk of collapse through human pressures and a further 26% are under a long-term threat of collapse (Wilkinson 2004). This decline is due to increasing human pressures; poor land management releasing more sediment, nutrients and other pollutants that stress the reefs; over-fishing with destructive fishing methods; coral diseases and coral predators such as the crown-of-thorns starfish and the predicted increases in ocean temperatures as a result of global climate change. Reef health varies between oceans and is the most critical in South-East Asia (Salvat 2005).

Sources of oil pollution in the oceans

The principal causes of oil pollution in the oceans are a) extraction of oil, b) transportation with ballast water release and tanker accidents and c) war-related incidents (Ramade 2000). At a global scale, it has been estimated that an important fraction of the 6 millions of tonnes of oil per year spilled into the world's oceans (Capone & Bauer 1992) is released into reef ecosystems (Ramade & Roche 2006). The distribution of oil pollution in the world's oceans is shown in Fig. 1. The polycyclic aromatic hydrocarbons, which are permanent components of crude oil and are also generated in incomplete combustions, rank among the most dangerous contaminants due to their acute and long-term toxicity (Ramade & Roche 2006).

Oil extraction has caused incidences of severe pollution. In 1966, 40000 t of oil leaked out of a broken pipeline off California. The worst pipeline accident happened in 1979 at the Ixtoc I pipeline offshore the Mexican coast and over 500000 t of oil was spilled (Ramade 2000). Five out of six of the world's worst pipeline disasters have occurred in the Caribbean region (OSIR 1999).

Transportation with ballast water release and tanker accidents are the second category of oil pollution. Over one billion tonnes of oil is transported annually in the world's oceans. It is estimated that 0.1-0.3% (about 1-3 million t) of this oil is released into the oceans in ballast water (Ramade 2000).

The majority of big spills (> 700 tonnes) between 1974-2005 were caused by tanker groundings (34.4%) and collisions (28.3%) (ITOPF 2006). The average quantity of oil spilled into the oceans during the 1990s was less than a third (11 40000 t) of that witnessed during the 1970s (31 42000 t) (ITOPF 2006). Between 1999 and 2004 there has been less than 50000 t of oil spilt per year. It is notable, however, that a few very large spills are responsible for a high percentage of the oil spilt (ITOPF 2006).

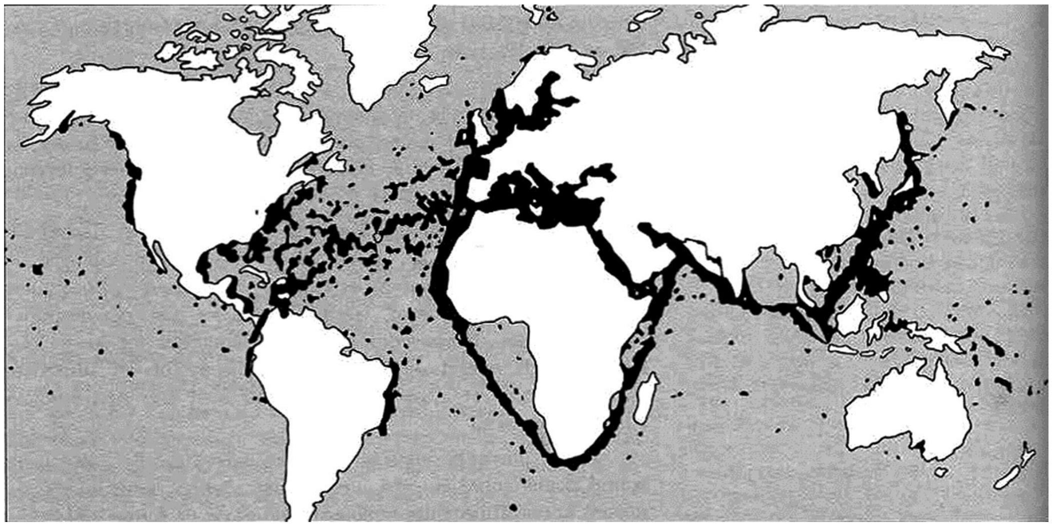

Fig. 1. – Distribution of oil pollution in the oceans (Ramade 1995, p. 286 after BP, op. cit.).

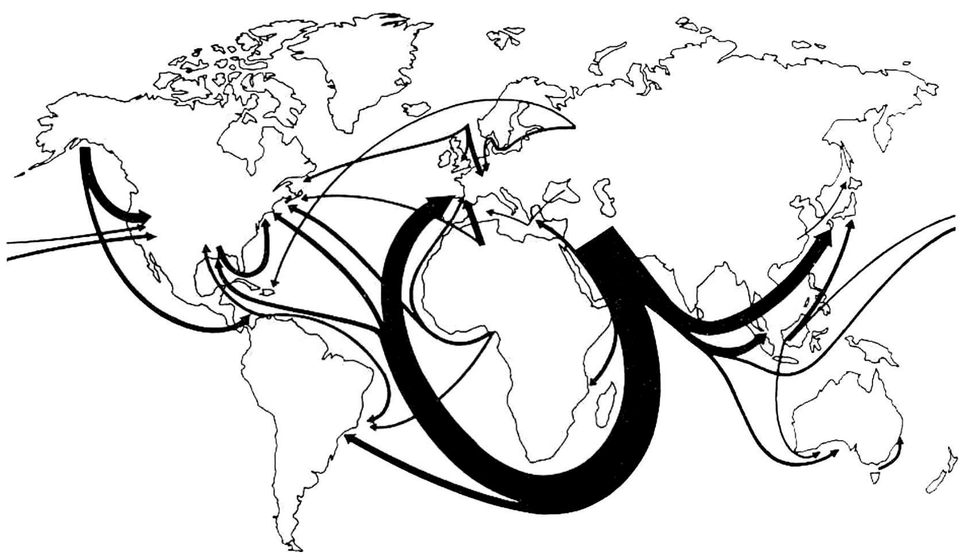

Fig. 2. – Major routes of oil transportation (Ramade 1995, p. 246 in OCDE, op. cit. p. 84).

No major oil pollution accidents on coral reefs have taken place recently, but the location of coral reefs in near-shore waters means that there is a potential danger to corals from tanker accidents, refinery operations, oil exploration and production (IPIECA 1992). The biggest accidental spills in tropical seas (offshore) occurred in 1972 in the Gulf of Oman (115000 t), in 1979 off Tobago (287000 t), and in 1992 off Mozambique (72000 t). Smaller incidents have been recorded in 1968 from Panama (2856 t of Marine Diesel and Bunker-C), in 1970 from the Seychelles (20000 t of fuel), in 1970 from Saudi Arabia (14280 t of Arabian Light Crude Oil) (Loya & Rinkevich 1980) and about 7784 t of medium-weight crude oil (70% Venezuelan crude and 30% Mexican Isthmus crude) off Panama in 1986 (Jackson *et al*. 1989). This was the largest recorded spill into a sheltered coastal habitat in the tropical Americas.

The Straits of Malacca and the South China Sea are nowadays considered as the area with the highest risk of tanker accidents (ITOPF 2006 pers comm). There is also a high risk for oil spillage in the Arabian Gulf which constitutes the busiest oil transport route in the world, through which more than half of the world's oil passes (Fucik *et al.* 1981) (Fig. 2). South and Central America and the Caribbean stand as the second largest potential producers of oil in the world after Saudi Arabia (OSIR 1999). In the Red Sea, poor environmental standards in the Egyptian oil fields of the Gulf of Suez, and deballast-

Table I. – Concentration of some PAH in the sediments from the Australian Great Barrier Reef (in mg.kg^{-1} d . w.) (after Haynes & Johnson 2000).

Locality	fluorene	pyrene	benzo(a) anthracene	chrysene	benzo(e) pyrene	benzo(k) fluoranthene	benzo(a) pyrene	benzo(ghi) perylene
Green island	<0.1-7.2	<0.1-15	<0.01-6	0.04-0.08	<0.1-6	<0.001-2.5	<0.004-4.3	<0.001-2.5
Port of Townsville	6.5 - 14000	10-4500	4.4-1700	7.5-1500		1-200	10-2600	3-1500
Heron island		<0.6-1.3	<0.1-8	<0.3-2		<0.001-0.5	<0.1-2.6	<0.3-6.7
National Park of D'Inchin-brook Island	7.3-15	7-15	<0.4-2.2	<2.2	0.3- 0.7		2.9-4.4	0.5-2.6
Port of Gladstone	<0.05	<0.1	<0.04	<0.2		16	820	200
John Brewer reef	<0.05	<0.1	<0.04	<0.2		<0.01	<0.01	<0.02

ing by ships in the southern Red Sea and Gulf of A d e n (Gupta & Kureishy 1981) are major factors contributing to oil pollution.

Acts of war are responsible for the worst oil spills in the world. In 1983, Iraqian airforces destroyed the Nowruz oil well platforms in the war between Iran and Iraq, and a total of 1 million t of hydrocarbons were released into the ocean (Ramade 2000). During the Gulf W ar (1991) the largest oil spill ever recorded (about 8 568 0 0 -11 42400 t) was released into the marine environment of the northern Gulf (e.g. Price 1998). The total leakage of oil into the marine environment was estimated to be about 1599 36000 t (Sadiq & McCain 1993), which was 42 times as extensive as the Exxon Valdez spill in Alaska in 1989 (Saenger 1994).

W ays of oil contam ination in coral reef habitats

After an oil spill, oil components dispersed in the water column can contaminate a reef in three diff e r e n t ways. Firstly, the surface oil at the air-water interface floats over the reefs and subsequently contaminates the intertidal scleractinian corals as they become exposed to air at low tide. Secondly, wave action can disperse oil as droplets within the water column. These droplets will sooner or later come into contact with corals. In some cases, these droplets can sink into deeper waters as they become combined with particles. Weathered oil can also sink in this way and come into contact with corals at greater depths (NOAA2003). When dispersants are used, they may have a detrimental effect on corals as they strongly increase the incorporation of oil into the water column and subsequently the potential of contact with corals. T h i r d l y, and far worse, is the long-term contamination due to oil incorporated into bottom sediments. This has a heavy impact on benthic biota with the cyclic release of toxic components of the oil from the sediment, and later through sedimentation of the un-degraded components from this oil that has been incorporated into faeces and dead organisms (Farrington 1989).

Impacts of oil pollution on corals

The impact of oil on coral ecosystems depends on many varying physical, chemical and biological factors that influence spilled oil and tend to make each incident a unique ecological problem.

Oil is a complex mixture of several thousand diff e r e n t molecular compounds, some of them can cause acute and/or long-term toxicity. A number of toxic molecules occur in the volatile fraction of oil, hence ecological damage can be lower when a spill takes place far off - s h o r e , since the oil has time to loose a significant part of its toxic components before it reaches coastal waters. However, the most hazardous oil components are included in the heavy fractions, namely the Polycyclic Aromatic Hydrocarbons (PAH) as well as various sulphur and nitrogen organic derivatives of high molecular weight.

PAHs can occur chronically in coral reef systems (Haynes & Johnson 2000), due to tanker wreckage, deballasting, and the deposition of atmospheric pollutants in r a i n w a t e r. Investigations have shown evidence of significant PAH contamination in the sediments of the A u s-tralian Great Barrier Reef (Table I).

Interacting factors which determine the nature and extent of the biological consequences of each spillage include: the type of oil, dosage, physical environmental factors, prevailing weather conditions, nature of the biota, seasonal factors, prior exposure of the area to oil, presence of other pollutants and type of remedial action (Straughan 1972). The recognition of a large range of stress responses shown by corals is complicated by the wide range of oils, oil fractions, and bioassay methodologies used in laboratory studies to date. Consequently,

Table II. – Range of property values for the lightest fraction of oils, light crude oils, medium oils with high and low pour points, and heavy oils. Examples for each group are given in parenthesis (Cormack 1999, reproduced by ITOPF and ETC Spills Te c h n o l o g y Databases).

Type of oil	**Specific gravity**	**Pour point**	**Viscosity cSt @ 15°C**	**% Boiling below 200°C**	**% Boiling above 370°C**
Lightest oils (e.g. gasoline, naphtha, kerosene)	<0.8 (°API>45)	too low to need quoting	0.5-2.0	50-100	0
Light Crude Oils (e.g. diesel, No. 2 fuel oil, Argyll, Beatrice, Nigerian Light)	0.8-0.85 (°API35-45)	>5 or <5 (are treated like heavy oils)	4-solid; average 8	10-48; average 35	0-40; average30
Medium oils with high pour point (e.g.: Suez Mix, Trinidad, Zaire, Mexican Isthmus) Medium oils with low pour point (e.g.: Arabian Light, Santa Maria, Forcados)	0.85-0.95 (°API 17.5-35)	>5 or <5 (are treated like heavy oils)	8-solid; average 275	14-34; average 25	28-60; average 45
Heavy oils (e.g. Bahia, Tia Juana Pesado, Wafra Eocene, Prudhoe Bay, Iranian crude, Venezuelan, Bunker-C)	0.95 (°API <17.5)	variable	1500-Solid	3-24; average 10	33-92; average 65

identification of trends or patterns of acute and sublethal responses of corals exposed to oil is difficult (Fucik *et al*. 1981). A summary of different types of oils is given in Table II.

Although oil pollution in the marine environment has been regarded as a major environmental hazard for several decades, little is known about the mechanisms in which crude oil affects natural marine populations and communities (Kushmaro *et al.* 1997). Most of the published scientific papers date from the 1970s and 1980s. A review article on the effects of oil pollution on corals was made in 1984 by Loya & Rinkevich.

These earlier papers have presented contradictory results. Johannes *et al.* (1972) concluded that some reef building corals may be seriously damaged if coated with oil when exposed to air at low tide, whereas Shinn (1972), stated that 'it would seem safe to conclude that crude oil spills do not pose a significant threat to Atlantic reef corals'. However, Shinn's (1972) conclusions were based on a qualitative study, without really measuring the rate of re-colonization and without having any data on the coral community structure prior to the study. Spooner (1970) reported no damaging effects to corals in a site chronically polluted by oil. It seems, however, that short-term, incidental or scattered observations may result in misleading conclusions and Stirling (1977) argued that ecological phenomena, such as those caused by oil spills in tropical seas, can be interpreted only when the physiological ecology and population dynamics of the fauna in relation to stability, recruitment and mortality are adequately understood.

Papers describing chronic pollution in the field (e.g. Rinkevich & Loya 1977), as well as short-term laboratory-based investigations (e.g. Harrison *et al.* 1990, Mercurio *et al.* 2004, Negri & Heyward 2000) have established that oil pollution may cause significant damage to reef corals.

The aim of this review article is to summarize scientific findings of the impacts of oil on corals both in the field and in the laboratory, and to suggest suitable management tools for oil spills on coral reefs.

1. Field observations of oil impacts

Field observations offer the best opportunity to understand the effects of oil spills, but they have been uncommon in coral reef habitats. Here we give an overview of the most important field studies. Table III summarizes these studies.

In situ experiment at Enewetak Atoll, Marshall Islands

Johannes *et al.* (1972) used Santa Maria crude oil in an *in situ* experiment at Enewetak Atoll, Marshall Islands. Twenty-two species of corals were transplanted and placed on two floating frames where a proportion of the corals was exposed to air. Oil was poured into the water around but not over the corals on one frame, producing an oil layer averaging 0.6 mm thickness. Oil adhered with greatest affinity to branching corals of the genera

Table III. – Summary of principal studies made on the effects of oil on corals in a natural environment.

Place and year	Type of oil	Effect on corals	Reference
Enewetak Atoll, Marshall Islands, 1971	Santa Maria crude oil. Oil was poured on corals exposed to air to form a 0.6 mm thick layer	Oil adhered with greatest affinity to branching *Acropora* and *Pocillopora* and some was still visible after 4 weeks. Corals showing no affinity for oil included *Fungia* and *Symphyllia*, both with large polyps and abundant mucus.	Johannes *et al*. 1972
Arabian Gulf field experiment, 1989	Arabian light crude oil for 24-120 hrs	No visible effects on corals.	LeGore *et al*. 1989
Panama, 1986	Medium-weight crude oil (70% Venezuelan, 30% Mexican Isthmus)	Total coral cover, species diversity and growth decreased, only *Zoanthus* sp. Has returned to normal after 18 months. *Acropora palmate* and *Siderastrea siderea* decreased the most. No recruitment of most formerly dominant species. Gonad size larger at un-oiled reefs.	Jackson *et al*. 1989 Guzmán *et al*. 1991 Guzmán *et al*. 1993 Guzmán and Holst 1993
The Gulf War, Arabian Gulf, 1991	Different types of oils	War-related events had only minor influence on changes observed on coral reefs.	Downing and Roberts 1993 Vogt 1995 Price 1998
Oil refinery in Aruba, chronic effects (1923-1985)	Heavy crude oil (Lake Maracaibo, Venezuela), refinery waste water, discharge clean-up with the dispersant Corexit since 1975	Spatial structure of the reef deteriorated, living coral cover low, less juveniles present. *Acropora palmata* most affected. *D. strigosa* quite tolerant to oil pollution.	Bak 1987 Eakin *et al*. 1993
Eilat, Red Sea, chronic oil pollution	Different types of oils	In the polluted area, only 44.6% of colonies contained gonads compared to 75.5% in the clean area.	Rinkevich and Loya 1977
Vessel grounding at Rose Atoll, American Samoa, 1993	Diesel fuel and lubricating oil	A massive die-off of coralline algae and invertebrates, blue-green algal blooms and a shift in algal communities.	Maragos 1994 Green *et al*. 1997
TROPICS Experiment, Panama (1984-1994)	Prudhoe Bay crude oil	A decrease in coral cover was observed after 20 months. After 10 years, neither coral cover or coral growth showed impacts of oil. Effects more serious to mangroves.	Ballou *et al*. 1987 Guzmán *et al*. 1991 Dodge *et al*. 1995 NOAA 2001 Ward *et al*. 2003

Acropora and *Pocillopora* and was visible on the corals after four weeks of observation. However, most of the oil disappeared within 1 day after colony submersion in clean water in corals with large and fleshy polyps and abundant mucus, such as *Fungia* and *Symphyllia*. A complete breakdown of soft tissue was seen on areas where oil adhered to the coral. It was concluded that floating oil may kill coral tissue if it adheres to corals when they are exposed to air.

Field experiment in the Arabian Gulf

LeGore *et al.* (1989) tested responses of corals to dispersed oil under realistic spill conditions on Jurayd Island, off the coast of Saudi Arabia. The design included exposure to Arabian Light crude oil with and without dispersants over periods of 24 h and 120 h. Study plots were established over existing coral reefs that were comprised mostly of *Acropora* spp. (more than 95%), with scattered colonies of *Platygyra* spp., *Goniopora* spp., and *Porites* spp. The plots measured 2 m by 2 m, located over approximately 1-m depth at low tide, and anchored in place.

The intention of this treatment was to simulate conditions of a typical Arabian Gulf oil spill and not to overwhelm the corals with "extraordinary and catastrophic stresses." As such, oil was added to test plots to produce a slick of 0.25 mm in thickness, in the 24-h oil-only treatment, and 0.10 mm thick in the 120 h-experiment. Water concentrations of hydrocarbons were measured by infrared methods, and no water column elevations were detected in the oil-only plots. The oil-only plots were visually inspected at the end of the 24-h and 120-h exposures, and they appeared normal. These areas were monitored for one year, and no extraordinary changes occurred relative to the un-oiled plots (seasonal changes in degree of bleaching, however, were noted across all monitored plots). While dispersed oil appeared to delay the recovery from seasonal bleaching, this was not observed in the oil-only plots. Growth rates, expressed as skeletal extension along branch axes, showed no correlation to treatment in

the 24-h exposure. There was some indication that growth rates were depressed with 120-h exposure, but LeGore *et al.* (1989) cautioned that these were not definitive. In summary, after one year of monitoring, the corals showed no visible effects after exposure to surface oil for 24 hours and for 120 hours. The authors concluded that healthy reef corals can tolerate brief (1 to 5-day) exposures to floating oil with no observable effect. They did note the potential for seasonal susceptibility to exposure in this region in the wintertime when low water temperatures stress corals.

Oil spill in Panama

Jackson *et al.* (1989) observed extensive mortality of subtidal reef corals and infauna of seagrass beds after an oil spill off the Panamanian coast in 1986. This spill consisted of about 7784 t of medium-weight crude oil (70% Venezuelan, 30% Mexican Isthmus crude oil). Damage caused by the accident was most extensive at the seaward border of the reef, where the oil accumulated at low tide. Most of the scleractinian corals still alive in depths less than 3 m showed signs of recent stress. These signs included bleaching or swelling of tissues, conspicuous production of mucus, recently dead areas devoid of coral tissue, and globules of oil. The most common sessile animals before the spill were zoanthids (*Zoanthus sociatus* and *Palythoa* spp.), hydrocorals (*Millepora* spp.), and scleractinian corals (*Porites* spp.). At the seaward border of the reef flat, populations of all these animals were severely reduced, and only *Zoanthus sociatus* had returned to typical abundance after 18 months. Total coral cover decreased by 76% at depths between 0.5-3 m and by 56% between depths of 3-6 m on the heavily oiled reef 3 months after the accident. Average size of coral colonies (all species) and species diversity also decreased significantly in relation to oiling (Guzmán *et al.* 1991). Cover of the large branching coral *Acropora palmata* decreased the most after the accident. This result lends further support to the claim that branching corals are most sensitive to human disturbance (Brown & Howard,1985). Frequency and size of recent injuries on massive corals increased with level of oiling, particularly for *Siderastrea siderea* (Guzmán *et al.* 1991).

Guzmán & Holst (1993) studied the effects of chronic oil-sediment pollution (type of oil not indicated, but expected to be the same as in the oil spill in 1986, i.e. 70% Venezuelan crude and 30% Mexican Isthmus crude) on the reproduction on *Siderastrea siderea* 5 years after the Panamanian oil spill in 1986. Coral fecundity (number of gonads/polyp and gonad size) was measured from 'healthy-looking' coral colonies, and coral colonies showing recent injuries or partial mortality (bleached areas), during the peak of reproductive activity at heavily oiled and un-oiled reefs over a period of 15 months. Gonad size (area) was larger at un-oiled reefs for most of the sampling period. According to Guzmán & Holst (1993), the size of gonads is a more sensitive measure of long-term (more than 3 yrs in this study) sub-lethal effects of oil on reproduction, than is the number of gonads or proportion of fertile colonies. Guzmán *et al.* (1993) found that there had been virtually no recruitment of most formerly dominant coral species, and that sub-lethal effects on vital processes (regeneration, growth, reproduction, and recruitment) are likely to persist for decades. This has been reported before from other areas by other authors (Loya & Rinkevich 1980, Bak 1987, Eakin *et al.* 1993). The causes of these effects are complex, but the 2 most important factors are re-oiling and sedimentation from adjacent mangroves. Estimated minimum times for recovery of the reef after the Panamanian oil spill in 1986 were 10-20 years on the assumption that no other events would further depress coral populations (Brown 1997).

The Gulf War,Arabian Gulf

The Gulf War in 1991 resulted in the largest oil spill ever recorded in history (about 8568 0 0 -11 42400 t) (e.g. Price 1998). The type of oil spilled in the incident has not been indicated.

Given the quantity of spilled oil, the recorded impacts to the environment were surprisingly low. Downing and Roberts (1993) observed some coral mortalities of a few species (*Acropora* spp., *Porites* spp. and *Platygyra* spp.) in Kuwait affecting different reefs in different ways, but thought it was unlikely that oil released during the war was the only cause of the decline. On the basis of video recordings made along transects between 1992 and 1994, Vogt (1995) concluded that live coral cover had significantly increased and that corals offshore from Saudi Arabia had survived the largest spill on record "remarkably unscathed." These findings were in accordance with other results (e.g. Price 1998). It must be notified that other environmental impacts from the war, such as reduced water temperature and lowered ambient light from oil fire smoke, may have obscured the actual effects of oil on coral (Vogt 1995).

Providing a single index as a "snapshot" of the health of an environmental system, which also captures the dynamics of the different ecosystems impacted, remains elusive, like in the Gulf War case. Additional difficulties include incomplete time-series, the possibility of misjudgments about species abundance and mortality from incomplete sampling, and the likelihood of synergism and antagonism between war-related effects, background impacts, and natural stresses (Price 1998).

The Gulf environment has many peculiarities which could have affected the fate of the oil. Being a semi-closed waterway linked to the Indian Ocean by the narrow Strait of Hormuz, the turnover time for waters of the Arabian Gulf has been estimated to 3.5 years. As a consequence of this slow turnover time and its dimensions,

extremely adverse and long-lasting effects were expected from this spill, raising considerable international concern. Oil pollution self-purification processes are considerably enhanced in the Arabian Gulf compared elsewhere. The Gulf environment has been subjected to hydrocarbon pollution for thousands of years through natural oil seeps originating in the seabed. Therefore, there is an assemblage of micro-organisms, that are adapted and acclimatised to oil pollution. The exceptionally high ambient temperature (reaching up to 35˚C during summer) accelerates the evaporation of light toxic fractions and some intermediate products of biodegradation and photo-oxidation (light-induced breakdown). The rate of photo-oxidation in the Gulf is extremely high compared to data reported from other parts of the world (Saenger 1994).

Chronic oil pollution in Aruba, Caribbean Sea

Bak (1987) & Eakin *et al.* (1993) showed clear evidence of chronic oil pollution (between 1923 and 1985) near a refinery in Aruba. Most of the oil processed was heavy crude from Lake Maracaibo, Venezuela. However, the dispersant Corexit had been used in clean up activities since 1975 (Bak 1987). The spatial structure of the reef had deteriorated, living coral cover was low and there were less juveniles in front and up to at least 9 km downcurrent of the refinery (Bak 1987). According to Eakin *et al.* (1993), *Montastrea annularis* had slowed growth rates in areas most affected by the refinery. *Acropora palmata* was the most affected species (Bak 1987), *M. annularis* and *Agaricia agaricites* were absent directly downcurrent of the refinery. It appeared that the gap in the distribution of *A. agaricites* was more extensive than that of *M. annularis*. *Diploria strigosa* was exceedingly dominant in the gap created by the absence of *M. annularis* and *A. agaricites* (Bak 1987). It was also suggested by laboratory experiments (Dodge *et al.* 1985) that *Diploria* spp. is possibly a hardier species with respect to oil pollution. According to Eakin *et al.* (1993), coral recruitment at the highly impacted sites showed hope for recovery if these environments are protected from renewed perturbation.

Chronic oil pollution in Eilat, Red Sea

Rinkevich & Loya (1977) studied the reproduction of *Stylophora pistillata* in a chronically oil-polluted area and a pollution free area in the northern Gulf of Eilat. In the clean area, 75.5% of 98 colonies studied contained gonads in their polyps, while in the polluted area, only 44.6% of 103 colonies contained gonads.

Vessel grounding at Rose Atoll, American Samoa

In October 1993, a Taiwanese fishing vessel ran aground on the remote Rose Atoll in American Samoa. The grounding resulted in the spillage of 379 tonnes of diesel fuel, 1895 litres of lubricating oil, and 1125 kg of ammonia onto the reef. The vessel eventually broke up before a salvage operation could take place and in six weeks, all the content of the ship was released onto the surrounding coral reefs. Substantial injuries from the physical impact of the vessel and the contaminant releases were detected (Maragos 1994). The most widespread and severe injuries to the atoll were from the release of diesel fuel. Amassive die-off of coralline algae and many reef-dwelling invertebrates was observed after the release, blue-green algae blooms were recorded where they are typically not found, and the structure of algal communities had shifted substantially. Green *et al.* (1997) stated that four years after the grounding, the affected areas remained visibly impacted – particularly with respect to cover of coralline algae. Natural re-colonization of the affected areas by native biota has been deemed by the preferred restoration alternative. It has been estimated that the impacted area of Rose Atoll reef will take several more years or perhaps decades to recover (Green *et al.* 1997).

TROPICS Experiment, Panama

The 1984-1994 Tropical Oil Pollution Investigation in Coastal Systems (TROPICS) effort, sponsored by the American Petroleum Institute, exposed a whole ecosystem (comprised of mangrove, seagrasses, and coral) to oil and chemically dispersed oil, in two separate boom-enclosed areas (NOAA2001).

The oiled site was treated with 953 litres of Prudhoe Bay crude oil released onto a boomed area of the water surface and allowed to remain for about two days. Tides and winds distributed the oil over the study area. After the exposure period free-floating oil was removed with sorbents. Chemical and biological monitoring continued for two years. Chemical monitoring, conducted hourly for the first 24 hours, confirmed that sediments and biota were exposed to rising and then rapidly declining dispersed and undispersed oil. For coral reefs, detailed transects were conducted to measure abundance of epibiota living on the reef surface. Four measurements were taken: total organisms, total animals, corals, and total plants. Growth rates of four coral species (*Porites porites, Agaricia tenuifolia, Montastrea annularis*, and *Acropora cervicornis*) were also measured. The only statistically significant effect documented over the first 20 months at the oiled site was a decrease in coral cover. No significant changes in growth rates of the four targeted corals were noted (Ballou *et al.* 1987). Ten years later, neither coral cover nor coral growth showed oil impacts (Dodge *et al.* 1995). The authors contrasted the finding of no impact from oiling alone to that described by Guzmán *et al.* (1991) at Bahía Las Minas, where significant effects of oil alone were found in several of the same species stud-

ied at TROPICS. Dodge *et al.* (1995) implied that these differences may have been due to the size of the spill at Bahía Las Minas and continued chronic exposure from oil trapped in the sediments.

Ward *et al.* (2003) returned to the site in 2001 and 2002 and found that there were still visible traces of the oil added in 1994 in the non-dispersed site sediments. The authors confirmed that the effects were more serious to the mangroves than to seagrass areas and corals: mangrove trees showed morphological prop-root deformations. The coral cover had increased from a pre-treatment value of 33.5% to 67.5% in 2001.

2. Laboratory studies on oil impacts

Many laboratory studies exist on the impacts of oil on corals. Extrapolating these results to real-life oil spill scenarios is complicated by the various exposures to different types of oil. Because only a fraction of the oil mixes directly into the water, actual toxicity levels can be assumed to be much lower than reported in many studies. During actual oil spills, oil is most concentrated at the very beginning of a spill and concentrations rapidly decline. When trying to estimate real-life exposures, it is important to carefully evaluate the methods used when extrapolating results from laboratory studies (NOAA 2001). Table IV summarizes the effects of oil on corals in laboratory studies and the associated references.

Growth

Several studies suggest that exposure to hydrocarbons affects coral growth especially by decreasing calcium deposition into the polyp's exoskeleton (Dodge *et al.* 1984). Guzmán *et al.* (1994) found an overall slow-down of coral growth after the Bahia Las Minas oil spill in Panama.

Histopathological effects

Peters *et al.* (1981) exposed the Caribbean coral *Manicina areolata* to No. 2 fuel oil (Chevron/Pascagoula, gravity, °API = 33-39) for three months (dosage 10 ml min^{-1}). The expected concentrations were 0.1 ppm and 0.5 ppm. Although corals remained alive, evidence of pathological responses were found which included impaired development of reproductive tissues, degeneration and loss of symbiotic zooxanthellae, and atrophy of mucous secretory cells and muscle bundles. Corals examined after two, four and six weeks after the start of the experiment showed an extensive increase in mucous secretory cell activity. This was indicated by a proliferation of mucous secretory cells as well as an increase in size of these cells in the epidermis and mesenteries. Many cells had increased to such an extent that their cell walls were broken and huge vacuoles were formed. Many mucous secretory cells were also noted in the tips of the mesenterial filaments, where they are not usually present. Zooxanthellae were not only lost from the gastrodermis, but also from the mesenteries.

Harrison *et al.* (1990) observed a dramatic decrease in zooxanthellae concentrations and a thinning of the tissue of *Acropora formosa* branches after 24 h of exposure to water accommodated fractions (WAF) of marine fuel oil. The response of the coral was similar in both 5 and 10 ppm treatments.

Reimer (1975) observed tissue rupture and flaking off of tissue especially at the edges of the *Pocillopora damicornis* colonies after 18, 55, 76 and 210 h exposure to Marine Diesel and Bunker-C oils. A massive extrusion of zooxanthellae was observed in *P. damicornis* when exposed to Marine Diesel. This led to bleaching, which occurred within 5-13 days of exposure to oil, and it affected mostly the lower side of the colonies. *Pocillopora damicornis* showed tissue death sooner than all other species investigated, it was affected more by longer expo-

Table IV. – Summary of the principal responses of corals to oil in laboratory.

Responses of corals to oil	Reference
Decreased growth rate	Dodge *et al.* 1984, Guzmán *et al.* 1994
Histopathological anomalies	Peters *et al.* 1981, Harrison *et al.* 1990, Reimer 1975, Mercurio *et al.* 2004
Changes in chemoreception, feeding response and behaviour	Blumer *et al.* 1971, Cohen *et al.* 1977, Reimer 1975, Loya and Rinkevich 1979
Oil-sediment rejection	Bak and Elgershuizen 1976
Mucus expulsion and changes in mucus bacteria	Johannes *et al.* 1972, Ducklow and Mitchell 1979, Loya and Rinkevich 1980, Palmork and Solbakken 1980, 1981, Knap *et al.* 1982, Harrison *et al.* 1990, Mitchell and Chet 1975, Garrett and Ducklow 1975, Ducklow 1977, Ducklow and Mitchell 1979, Antonius 1981
Decreased reproduction	Rinkevich and Loya 1979, Peters *et al.* 1980
Impaired larval metamorphosis and recruitment	Chia 1973, Rinkevich and Loya 1977, Cohen *et al.* 1977, Rinkevich and Loya 1979, Harrison *et al.* 1984, Kushmaro *et al.* 1997, Negri and Heyward 2000
Bioaccumulation	Burns and Knap 1989, Readman *et al.* 1996

sures than by shorter ones and is more susceptible to tissue damage and bleaching by Marine Diesel than by Bunker-C.

Zooxanthellae expulsion was also observed in colonies of *Acropora formosa* exposed to hydrocarbon components originated from lubricating oils. A decrease of the maximum quantic photosynthetic efficiency (F_v/F_m) occurred at concentrations ranging from 150 $\mu g.l^{-1}$ and over (Mercurio *et al.* 2004).

Chemoreception, feeding response and behaviour

Crude-oil products may interfere with chemically mediated behaviors by blocking the taste receptors of marine organisms or by mimicking natural stimuli and thus eliciting false responses (Blumer *et al.* 1971).

Cohen *et al.* (1977) exposed the soft coral *Heteroxenia fuscescens* to different concentrations of Iranian crude oil in static bioassays (1-30 ml^{-1}). The initial effect of crude oil (even in the lowest concentration) was a reduction in pulsation rate to less than 50% of the rate in untreated colonies. At concentrations of 10 ml^{-1} and greater, pulsation stopped almost completely within 72 h. After 17 days of recovery, the pulsation rate of treated colonies was 20-30% lower and less regular than in control colonies. In large tanks (1500 l, 1-2 m deep) with a continuous flow of seawater (oil concentration of 10 ml-1), a similar reduction in pulsation rate was recorded.

Some scleractinian and zoantharian corals have been reported to respond to crude-oil pollution by mouth opening (Reimer 1975, Loya & Rinkevich 1979). Reimer (1975) described abnormal feeding reactions in four scleractinian corals (*Pocillopora damicornis, Pavona gigantea, Psammocora stellata* and *Porites furcata*) elicited by Marine Diesel and Bunker-C oils floating over the surface water covering the corals. *P. damicornis* was treated with 1 ml of Marine Diesel in a 250-ml finger bowl and was shown to exhibit exaggerated mouth opening which lasted up to 17 days. Control colonies kept their mouths closed throughout 20 d of observation. Mouth opening responses in *Pavona gigantea, Psammocora stellata* and *Porites* sp. were sustained for much longer periods than normal after exposure to Marine Diesel.

Oil-sediment rejection patterns in corals

The sediment rejection behaviour pattern of corals displays maximum and minimum rates dependent on the size and density of the oil-sediment particles. Viscosity of the oil determines the size of the oil-sediment particles (Bak & Elgershuizen 1976).

Different rejection patterns of sand-oil combinations by various coral species were tested by Bak & Elgershuizen (1976). The oil used in the experiment was a combination of Nigerian, Forcados and Tia Juana Pesado crude oils (see Table I for details), as well as Forcados long residue and Lagomar short residue. Small drops of these oils were introduced in the grastrovascular cavity of the corals. The viscosity of these oils increased in this sequence at the temperature of the experiments (26° to 28°C) (Bak & Elgershuizen 1976). No evidence of adsorption of oil to living coral tissue was found: if drops were introduced into the gastrovascular cavity they were invariably extruded through the stomodaeum. When oil drops arrived on the peristome they were removed by ciliary currents and by tentacular and polypal movements (Bak & Elgershuizen 1976).

The reaction of corals to sediment is intimately linked to the specific morphology of the coral colonies affected. Long, meandroid valleys are more advantageous than short, reticulate valleys. Calical morphology also affects the mobility of polyps. *Agaricia agaricites* is an example of a species depending on strong ciliary currents for sediment rejection. *Acropora palmata* and *Porites asteroides* are, without help of wave action or currents, unable to remove particles of any size (Bak & Elgershuizen 1976).

Mucus expulsion and coral reef food-web

Mucus secretion by reef corals as a protective mechanism in response to external perturbations is well known. Johannes *et al.* (1972) found that corals with large and fleshy polyps with abundant mucus cleaned themselves in 1 day after colony submersion in clean water. Harrison *et al*. (1990) observed massive amounts of mucus discharging from branches of *Acropora formosa* when exposed to 5 and 10 ppm of marine fuel oil.

Under normal conditions, mucus loss may be a major pathway of energy loss. Thus, 40% of the primary production of a species of *Acropora* is rapidly lost as mucus (Loya & Rinkevich 1980). In stressed corals this loss might constitute an enormous energy drain, which could lead to a deterioration in general coral health.

Knap *et al.* (1982) measured the uptake and the depuration of (9-14C) phenanthrene (Solbakken *et al.* 1979) in individual colonies of the brain coral *Diploria strigosa*. After 10 days, a 4000 times higher concentration of phenanthrene was found in the tissue than in the mucus. It was concluded that the uptake of (9-14C) phenanthrene by *D. strigosa* is similar to that of other invertebrates (Palmork & Solbakken 1980, 1981). The very low concentration of radioactivity in the mucus after 10 days may be due to a very high turnover rate of mucus by the coral or may be due to the chemical nature of the mucus (Ducklow & Mitchell 1979), and its inability to sorp petroleum hydrocarbons to any great extent. Knap *et al.* (1982) stated that the slow depuration rates exhibited by *Diploria strigosa* indicate that these organisms may prove to be useful bio-indicators of marine pollution incidents in coral reef areas.

Particulate mucus has been shown to be consumed by a large variety of coral-reef organisms (Johannes 1967,

Knudsen 1967, Benson & Muscatine 1974, Richman *et al*. 1975, Lewis 1978). Although there is no conclusive evidence of possible transfer of oil derivatives through the reef food chain, which originates from coral mucus, this remains one possible route, as demonstrated in other organisms, such as clams (Stainken 1975). Another way is through direct feeding on coral tissue, which might contain accumulated hydrocarbons.

Effects of bacteria

The relationship between mucus production and bacterial growth was studied on colonies of *Platygyra* spp., which was exposed to crude oil (oil type not specified) (Mitchell & Chet 1975). It was concluded that crude oil alone fails to kill coral at concentrations of 100 ppm but the role of the bacteria which developed under such stress conditions was demonstrated. Three groups of microorganisms were suggested to be responsible for the observed coral death: predatory bacteria, *Desulfovibrio* and *Beggiatoa*.

A significant increase in mucus-bacteria populations and a significantly higher diversity of bacterial types in clean coral-mucus than in oil-exposed mucus were indicated by Ducklow (1977) and Ducklow & Mitchell (1979).

After the oil spill in Panama in 1986, bleached areas on corals were surrounded by a black halo characteristic of bacterial infection (Antonius 1981). Garrett & Ducklow (1975) suggested that naturally occurring diseases in corals, e.g. the black band disease (BBD), may result from stress conditions such as oil pollution. Recent evidence of the human impact on the occurrence of BBD has been suggested by Littler & Littler (1996) and Friaz-Lopez *et al.* (2002).

Reproduction

Rinkevich & Loya (1979) investigated the sub-lethal, detrimental effects of Iranian crude oil on *Stylophora pistillata* in a long-term laboratory experiment. The experiment consisted of four 1500-l capacity tanks with continuous flow of sea water; every week 2 of these tanks were polluted by Iranian crude oil (3ml^{-1} sea water) for 24 h. Large and mature colonies of *S. pistillata* were cut into halves, at the beginning of the reproductive period; one half was placed in a polluted tank, the other in a clean tank. After 2 months, a significant decrease in the number of female gonads per polyp was recorded in 75% of the polluted halves. This experiment showed that chronic oil pollution damages the reproductive system of scleractinian corals, a fact that had already been shown in the field by the same authors (Rinkevich & Loya 1977).

Harrison (1994) observed total sterilization of gametes of *Acropora tenuis* occurring at a concentration of 0.002 mgL^{-1} of heavy fuel oil.

Mercurio *et al.* (2004) stated that 150 mgL^{-1} of lubricating oil generated a 64% decrease in the fecundity of gametes of *Acropora microphtalma* in comparison to the control.

Larval metamorphosis and recruitment

Field documentation (Loya 1976) combined with laboratory experiments (Rinkevich & Loya 1979) recorded that chronic oil pollution inhibits successful settlement of coral planulae.

According to Rinkevich & Loya (1979), the shedding of larvae in *S. pistillata* is immediate in the presence of low concentrations of the water soluble fraction of Iranian crude oil, during day or night. Most larvae are prematurely released (planulae without complete mesenteries or with 2-4 pairs of complete mesenteries). The chances of survival of such planulae are very low, due to the high predation pressure existing in the reef from a wide variety of organisms. Chia (1973) demonstrated that species specificity, in terms of survival of the larvae in oil-polluted water, may be related to size; larger larvae are expected to survive longer because they are more robust. Larval extrusion due to sublethal concentrations of crude oil (10 ml l^{-1}) was also reported in the soft coral *Heteroxenia fuscescens* after 72 h of exposure (Cohen *et al.* 1977). Since planulae extrusion occurs during an oil spill, chances of survival and successful larval settlement are very low. Gametes of most spawning species tend to rise to the surface just after spawning (Harrison *et al.* 1984) where they are more likely to encounter oil, and their larvae spend one to several weeks in the plankton before attaining competence to settle (Fadlallah 1983, Jackson 1986). Brooding species release planulae throughout the year (Guzmán 1991). Serious impacts on coral recruitment would therefore follow in the case of a simultaneous spill and coral spawning.

Negri & Heyward (2000) reported the effects of the water accommodated fraction (WAF) of crude oil, (specific gravity of 0.93 (19.4 API), kinematic viscosity of 128 cSt at 23°C, pour point -39°C and flash point 87.0°C) and production formation water (PFW) on fertilization and larval metamorphosis of *Acropora millepora*. At 20% v/v, PFW fertilization was inhibited by 25%. This concentration was equivalent to 0.0721 mg l^{-1} of total hydrocarbons (THC). In contrast, larval metamorphosis was more sensitive to this effluent, with 98% metamorphosis inhibited at the same concentration. Crude oil WAF did not inhibit fertilization of gametes until dispersant was introduced. Crude oil inhibited metamorphosis at 0.0824 mg l^{-1} THC.

Kushmaro *et al.* (1997) used TPA (12-tetra-decanoyl-phorbol-13-acetate) to induce metamorphosis of planulae of the soft coral *Heteroxenia fuscescens*. In the absence of crude oil (obtained from Haifa refineries, Israel, density: 0.8497 g/ml), TPA induced metamorphosis in 97% of these planulae. Only 50% of the planulae grown in exper-

imental vessels with crude oil at a concentration of 0.1 ppm covering the bottom and walls of the vessels underwent metamorphosis when triggered by T PA. Of those planulae exposed to 100 ppm of the pollutant only 3% metamorphosed after being induced by T PA. In addition, after metamorphosis there was an increase in the number of deformed primary polyps compared to the control. The deformed polyps were elongated and had short non pinnate tentacles. Planulae also settled less frequently on the oil-covered surfaces. Thus, on the reef, even in the presence of low concentrations of crude oil, a decrease in both viability and successful settlement of coral planulae might occur following an oil spill.

Bioaccumulation

According to Ramade & Roche (2006), the high lipid content of coral polyps increases their ability to retain hydrocarbons (and more broadly any lipophilic pollutants). Researchers have found that petroleum hydrocarbons are deposited into the calcareous exoskeleton of corals, which introduces the possibility of using coral skeletons as historical records of hydrocarbon contamination in an area. Field studies in Bahía Las Minas indicated that corals took up hydrocarbons from the water column, as opposed to sediments (Burns & Knap 1989). Readman *et al.* (1996) analysed sections of the massive coral *Porites lutea* from the Gulf coast of Kuwait and Saudi Arabia and found clear evidence of the Gulf War oil spill recorded in the skeletons of these corals.

3. Oil spill management techniques on coral reefs

Unless otherwise stated, the following chapter is based on the information found in the "Field guide for oil spill response in tropical waters" published by the International Maritime Organisation (IMO) (1997) and the "Oil spills in coral reefs: Planning and Response Considerations" published by National Oceanographic and Atmospheric Administration (NOAA) (2001).

Generalities

The goal of spill response in coral areas is the same as in any other habitat – to minimize damage caused by accidents and any associated spillage. Choosing response methods carefully, with an understanding of the sensitivities of the reef environment, will minimize any additional impacts incurred from the cleanup. Variables such as type and amount of oil spilled, geology of the shoreline, rate of water flow, weather, and availability of equipment for salvage will determine which options can be considered during a response. Problems that have to be solved are the possible remoteness of the site, lack of adequate equipment, the difficulty of navigation in shallow waters, and storage and disposal of collected oil.

Possible clean-up methods for coral reefs

Booms and skimmers

The first stage of an effective response is to deploy a boom to limit further spreading and concentrate the oil for recovery (ITOPF 2006). Booms and skimmers can be used in relatively calm waters near reefs or in lagoons, but certain types of booms need to be limited to deeper waters (greater than 3 m) to avoid direct physical impacts to the corals.

Sorbents and vacuum pumping

Sorbents and vacuum pumping are techniques which could be used in lagoons. Vacuum pumping may be used to remove thicker oil layers and oil pockets, but care should be taken to avoid breaking coral heads.

Low-pressure flushing

This technique is an effective way of aiding natural removal, but care must be taken when treating reefs.

Natural cleansing

This is the best method in many cases if there is high wave action on fringing reefs.

Agents and nutrients

Several methods currently in the developmental stage appear to be potentially suitable for use in coral areas and other marine environments likely to be sensitive to oil. Among these are agents that have been developed that, when added to oil, gel in a semisolid form that can then be recovered. Research is also being carried out to use nutrients (e.g. nitrogen and phosphorous) in accelerating the bacterial biodegradation of oil. According to ITOPF (2006), the use of nutrients has not so far been demonstrated to be beneficial for large-scale restoration projects. Bioremediation products should be applied with care and the methods used must be specifically tailored to the environment and pollutant at each contaminated site because they might encourage the growth of alien species (ITOPF 2006).

Bacterial biodegradation

Oil degrading microbes are widely distributed throughout the world's coastal areas and are more abundant in coastlines adjacent to chronically polluted waters such as those receiving industrial discharges and untreated sewage. Some commercially available products do combine oil-degrading microbes collected from assorted areas of the world with nutrient supplements. Their application at a spill site can result in the introduction of alien species resulting in concerns about their potential impact. However, in most cases it is likely that introduced species will not compete effectively with those species naturally occurring. Although bioremediation may improve the rate of degradation of floating slicks the process is still too

slow to prevent the vast majority of the oil reaching the shoreline. One problem is that some of the more complex components of the oil may remain partially or totally undegraded (NOAA2001).

In situ *burning*

To date, there have been no intentional large-scale *in situ* burns in coral reef habitats, neither has there been any studies of this technique in coral regions. Results from the Newfoundland Offshore Burn Experiment (NOBE) indicate that crude oil burn residue has a low inherent toxicity to test organisms, and incurred no additional toxicity over unburned oil (Blenkinsopp *et al.* 1997). Extrapolation of these results to tropical areas and coral reefs should be done cautiously, however. The physical impacts of contact (such as fouling or smothering) may be a concern, since the burn residue may sink. There would be no harm to corals caused by the temperature rise because it only takes place in the first few centimeters of water.

Dispersants

The use of dispersants should be restricted to deep water, away from the shore and away from environmentally fragile habitats. The use of dispersants should not be undertaken if the risk caused to the environment by dispersed oil is higher than the risk caused by the oil itself. The decision about using a dispersant has to be made quickly so that the oil does not have the time to reach the shore (Merlin 2005).

The use of dispersants is not recommended on coral reefs because they are likely to increase hydrocarbon concentration in the water column thereby increasing the exposure of corals to oil and because of their deleterious environmental impacts discussed in the following chapter.

4. Effects of dispersants

Most of the research on the effects of dispersants on corals has been done in the laboratory. All these results conclude that chemical dispersants are toxic to corals. Table V summarizes these findings.

In Panama in 1986, the dispersant Corexit 9527 was both observed and reported to have been applied mostly offshore, and always > 2-3 km away from the heavily oiled reef (Guzmán *et al.* 1991). Refinery officials reported spraying from aircraft of over 21000 litres of the dispersant (Guzmán *et al.* 1991). It was used too late and at concentrations too low relative to the volume of spilled oil to be effective (Cormack 1983), and may have mixed directly into the water column soon after spraying, or accumulated on top of the floating oil. Corexit has also been described as toxic to reef corals by other authors (Ballou *et al.* 1989, Thorhaug *et al.* 1989), or not toxic at concentrations up to 50 ppm (Knap *et al.* 1985). Ballou *et al.* (1989) stated that dispersants (Corexit) had less effects on mangroves than on corals.

Lewis (1971) reported detrimental effects to the feeding response and tactile stimuli of four Caribbean corals, due to Corexit. Of the four species tested (*Porites porites, Madracis asperula, Favia fragum* and *Agaricia agaricites*), *M. asperula* exhibited the greatest ill effects. Feeding activity decreased markedly upon additions of 100 ppm of Corexit, and at 500 ppm all but 5% of the colonies appeared moribund when compared to controls. All species were more affected by the dispersant than by the crude oil (General Crude Oil Co. of Barbados). This was also concluded in the case of the soft coral *Heteroxenia fuscescens* (Eisler 1975). Cook & Knap (1985) observed a photosynthesis reduction of 85 % in *Diploria strigosa* after an eight-hour exposure to a mixture of Arabian crude oil (19 ppm) and of the oil dispersant Corexit 1289 (1 ppm).

Negri & Heyward (2000) exposed corals to the dispersant Corexit 9527 and found that it inhibited fertilization as well as larval metamorphosis of *Acropora millepora.* But it was more toxic when combined with the crude oil. Dispersed oil was slightly more toxic to fertilization than dispersant alone, suggesting toxicity to that event may be additive. The minimum concentration of dispersed oil which inhibited fertilization was 0.0325 mg l^{-1} THC. Although crude oil and dispersant inhibited larval metamorphosis individually, this toxicity was magnified when larvae were exposed to combinations of both. Crude oil inhibited metamorphosis at 0.0325 mg l^{-1} THC when dispersed in 10% v/v (dispersant/oil).

Effects of the dispersant Shell LTX on the Caribbean coral *Madracis mirabilis* were studied (Elgershuizen & De Kruijf 1976). The Shell dispersant LTX, applied on the surface of the coral exposed to air was not toxic by itself, but mixed with seawater the toxicity increased 3-6-fold compared to the dispersant itself. The dispersant was added in a ratio of 1:10 (dispersant : oil). The increase in toxicity is probably caused by the increase in number of oil droplets and therefore, an increase in contact area between water, oil and dispersant. Elgershuizen & De Kruijf (1976) concluded that in the case of a major oil spill, reefs are more endangered by clean-up with chemical detergents than by the oil itself and the use of mechanical removal of the oil is preferred.

Harrison *et al.* (1990) observed a delayed stress response among branches of *Acropora formosa* exposed to dispersant BPA-B. Tissues began to lose zooxanthellae during the experiment and continued to deteriorate over subsequent weeks resulting in death of some branches after 1-2 months. The authors recommend not to use this dispersant in the vicinity of coral reefs until its toxicity is more thoroughly investigated.

Harrison (1994) reported inhibition of fertilization of the coral *Acropora tenuis* by fuel oil and the dispersant Ardrox 6120, noting that the dispersant was more toxic towards fertilisation than the water accommodated fraction of fuel oil.

TableV. – Summary of effects of dispersants on corals

Dispersant	Dose	Species	Effects	Reference
Corexit	100-500 ppm	*Porites porites, Madracis asperula, Favia fragum* and *Agaricia agaricites*	Ill effects on feeding response and tactile stimuli.	Lewis 1971
Corexit 9527	< 21 000 litres applied mostly offshore after the oil spill in Panama	Coral reef and mangrove ecosystem in Bahia Las Minas, Panama	Toxic effects on corals, less on mangroves.	Guzmán *et al.* 1991 Ballou *et al.* 1989 Thorhaug *et al.* 1989 Ward *et al.* 2003
	0.0325 mg l^{-1} THC	*Acropora millepora*	Inhibited fertilization and larval metamorphosis.	Negri and Heyward 2000
Corexit 1289	Mixture with Arabian crude oil (19 ppm) and Corexit 1289 (1 ppm)	*Diploria strigosa*	Reduction of photosynthesis by 85%.	Cook and Knap 1985
Shell LTX	1:10 (disp:oil)	*Madracis mirabilis*	Mixed with seawater the toxicity of the dispersant increases 3-6-fold.	Elgershuizen and Kruijf 1976
BP A-B	2-4 ppm	*Acropora formosa*	A delayed stress response (1-2 months) resulting in coral death.	Harrison *et al.* 1990
Ardrox 6120	Not known.	*Acropora tenuis*	Inhibition of fertilization.	Harrison 1994
Third generation dispersants (Inipol IP-90, Petrotech PTI-25, Bioreico R-93, Biosolve and Emulgal C-100)	0.1%, 1%, 10% and 100%	*Stylophora pistillata* and *Heteroxenia fuscescens*	Larval morphology deformations, loss of normal swimming behaviour and rapid tissue degeneration. Toxicity from the least toxic compound: Petrotech<Biosolve<Emulgal <Bioreico=Inipol	Epstein *et al.* 2000

Epstein *et al.* (2000) carried out a laboratory study on the survival of the planulae of *Stylophora pistillata* and *Heteroxenia fuscescens* from the Gulf of Eilat, Red Sea. Five third-generation oil dispersants, said to be environmentally friendly (Inipol IP-90, Petrotech PTI-25, Bioreico R-93, Biosolve and Emulgal C-100) were tested. Concentrations ranging from 0.5 to 500 ppm of dispersant compounds were mixed in 1/10 ratio with an Egyptian crude oil. A strong decrease of survival and settlement rate of planulae was observed for dispersant exposure ranging from 50 ppm and over, while metamorphosis rate was affected (60% to 84% fewer than control depending on the considered compound) at concentration as low as 0.5 ppm. Dispersants and water accommodation fractions (WAF) treatments caused larval morphology deformations, loss of normal swimming behaviour and rapid tissue degeneration. The dispersant Petrotech PTI-25 was shown to be the least toxic of the products, but Epstein *et al.* (2000) do not support the application of dispersants in the vicinity of coral reefs.

Ward *et al.* (2003) concluded that the TROPICS long-term study clearly showed the trade-off between using dispersants and not using them: efficient dispersant use saves the mangroves, but is harmful in shallow water where dispersants are in contact with the corals. The results in this study point out the trade-offs in habitat survival that different management decisions could make to inter-tidal and sub-tidal habitats (IPIECA1992).

CONCLUSIONS

It has been stated that coral reefs are currently the most threatened ecosystem of the planet (Wilkinson 2004, Ramade 2005, Salvat 2005). Widespread occurrences of total coral colony mortality, partial mortality, population decline, and apparent decreases in coral recruitment have been reported on many reefs (Pandolfi *et al.* 2003). Since corals are among the most important organisms in tropical reef communities, both by providing habitat for other o rganisms and by entering in the overall metabolism of the reef community, any change in their physiology, however subtle, will probably cause a very dramatic change in the overall ecology of the reef (Reimer 1975). Oil pollution is one threat in the long list of threats to coral reefs.

Our literature review concerning oil spills on coral reefs reveals that the majority of the research has been conducted in the 1970's and 1980's. Very little research on this subject has been done after 1990 and an almost negligible amount after 1995. Results of the earlier studies were often contradictory. The discrepancies in these research findings result from the different types of corals, oils and dispersants studied; the wide range of exposure times, environmental conditions, and dosage concentrations used; the methods used to measure stress; and the length of time corals were monitored for recovery. Most of the research has been done in the Caribbean and in the Red Sea. Different types of corals and corals from diff e r-ent regions have been found to vary greatly in their response to oils and dispersants. It is therefore difficult to apply the results of these studies to predict the effects of oil spills and dispersant clean-up operations in the Indo-Pacific (Harrison *et al.* 1990).

Confusing results, the lack of new research, and the wide array of oils and dispersants available on the market call for a need to do further research on thresholds of damage of these new products to coral physiology. Research conducted in field conditions is important, because the extrapolation to natural populations from laboratory-based physiological data or small-scale, short-term perturbations have proven to be dangerous.

All efforts should be made in order to prepare the best clean-up methods for the reef environment in case of an oil spill. Studies confirm the toxicity of dispersants to corals and their use is not recommended (e.g. Harrison *et al.* 1990). During the last few years, earlier generations of oil dispersants were replaced by newly developed, "environmentally friendly" third generation compounds which were claimed to be less toxic. However, as Epstein *et al.* (2000) point out, these new products have serious negative impacts on coral larvae behaviour and recruitment. Ward *et al.* (2003) point out following the TROPICS experiment case in Panama that the use of dispersants is often a trade-off between the impact on corals and mangroves. In this particular case, eff i c i e n t dispersant use saved the mangroves, but was harmful in shallow water where they were in contact with corals.

The most suitable clean-up method on shallow fringing reefs and reefs with high energy is considered to be natural clean-up. In order to act rapidly and effectively in case of an oil spill, thorough contingency plans are needed in coral reef countries. This is a challenging task considering that the majority of them are Third World countries with limited infrastructure and resources at their disposal.

So far, there has been no major oil pollution incidents on the world's coral reefs, but chronic pollution from small day-to-day spills in coastal waters is large in total volume (Guzmán 1991). Sublethal effects from this chronic pollution are extensive and may be more important in the long-term than initial mortality (Loya & Rinkevich 1980, Southward 1982).

The most extensively documented case study on the impacts of oil pollution on corals is that of Bahía las Minas, Panama, following the oil spill in 1986. T h e TROPICS experiment, also in Panama, has so far been the most extensive field study of the impacts of oil and dispersants on several biological habitats. As a result from this spill, an enormous amount of oil was locked in the mangrove sediments and chronic pollution due to the original oil spill is likely to last for many years. However, the chemical composition and toxicity of the oil is likely to have changed considerably over time, so that chronic e ffects may be less than were observed after the oil spill (Guzmán *et al.* 1991). Although petroleum released to the sea in tropical environments generally suffers rapid degradation, petroleum contaminants reaching intertidal sediments may exhibit long-term persistence (Corredor *et al*. 1990). Loya & Rinkevich (1977) pointed out the need for base-line biological studies in regions with a high probability of future subjection to oil pollution. This will lead to better evaluation and quantification of long-term e ffects of hydrocarbons on animal and plant communities. Various features of the life history of species composing such communities should be quantified and when possible, coupled with controlled experiments in the laboratory.

The responses of organisms to an oil spill, or any other major disturbance will depend on the conditions in which they normally live (e.g. Woodley *et al.* 1981). Moreover, the suite of organisms able to survive under conditions of chronic pollution, and their resistance to further stress, is typically different from that in similar unpolluted habitats (Southward 1982, Bak 1987). The exposure to chronic oil pollution of corals in the Arabian Gulf area may therefore explain the lack of impacts on corals observed after the w o r l d 's biggest oil spill resulting from the Gulf Wa r. Observations in the Gulf indicate that coral communities exist at their ecological limits with respect to low temperature (Coles & Fadlallah 1990) and high salinities (Coles & Jokiel 1991), a fact that further increases the stress tolerance of corals in this region.

According to Ramade & Roche (2006), a number of unsolved questions are still pending in the field of ecotoxicology of coral reefs. An effective monitoring program and standardised analytical processes for assessing the exposure of scleractinian corals to xeniobiotics should be put into place. There have been very few studies on accumulation and biomagnification processes in the coral reef trophic web and these studies should be undertaken as soon as possible. Coral planulae, amphipods, larval stages of crustaceans and echinoderms could be used for assessing the toxicity of different pollutants. These young life stages have been proven to be very useful in monitoring pollution because of their high sensitivity to pollutants. Studies on biomarkers in coral reefs have been rare and should be equally put into place (Ramade & Roche 2006).

When considering the possible risks of an oil pollution accident on a coral reef, the life cycle of the corals on site is crucial. Detrimental effects would follow if a spill occurs during an annual coral spawning event, but also if it occurs during the subsequent 1-3 week period during which most larval metamorphosis and recruitment occurs (Harrison *et al.* 1984).

The estimated reef recovery time of 10-20 years in Panama in 1986 was based on the assumption that no other event would further depress coral populations (Brown 1997). In the light of the current health of corals worldwide and the array of problems facing this ecosystem (e.g. Pandolfi *et al.* 2003), a major oil spill might mean a point of no return for corals. The risk of oil pollution should therefore be taken seriously.

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REFERENCES

Antonius A1981. Coral reef pathology: a review. *In* Proceed 4th Intern Coral Reef Sympos 2: 7-14.

Bak RPM, Elgershuizen JHBW 1976. Patterns of oil-sediment rejection in corals. *Mar Biol* 37: 105-113.

Bak RPM 1987. Effects of chronic oil pollution on a Caribbean Coral Reef. *Mar Poll Bull* 18: 534-539.

Ballou TG, Hess SC, Dodge RE, Knap AH, Sleeter TD 1987. Effects of a Dispersed and Undispersed Crude Oil on Mangroves, Seagrasses, and Corals. API Publ N° 4460. Washington, D.C: American Petroleum Institute, Health and Environmental Sci Dept, 198 p.

Ballou TG, Hess SC, Dodge RE, Knap AH, Sleeter TD 1989. Effects of untreated and chemically dispersed oil on tropical marine communities: A long-term field experiment. *In* Proceed 1989 Intern Oil Spill Conf, San Antonio, Texas. Am Petroleum Inst, Washington, DC: 447-454.

Benson AA, Muscatine L. 1974. Wax in coral mucus: Energy transfer from corals to reef fishes. *Limnol Oceanogr* 19: 810-814.

Blenkinsopp S, Sergy G, Doe K, Wohlgeschaffen G, Li K, Fingas M 1997. Evaluation of the toxicity of the weathered crude oil used at the Newfoundland Offshore Burn Experiment (NOBE) and the resultant burn residue. *In* Proceed 20th Arctic and Marine Oil spill Program (AMOP) Technical Seminar, Vancouver, British Columbia, June 11-13, 1997: 677-684.

Blumer M, Sanders HL, Grassle JF, Hampson GR 1971. Asmall oil spill. *Environment* 13: 1-18.

Brown BE, Howard LS 1985. Assessing the effects of 'stress' on reef corals. *Adv Mar Ecol* 22: 1-63.

Brown BE 1997. Disturbances to reefs in recent times. *In* Birkeland C ed, Life and death of coral reefs: 373-374.

Burns KA, Knap AH 1989. The Bahia Las Minas oil spill: hydrocarbon uptake by reef building corals. *Mar Poll Bull* 20: 391-398.

Capone DG, Bauer JE 1992. Microbial processes in coastal pollution. *In* R Mitchell ed, Environmental microbiology, John Wiley and Sons, New York: 191-238.

Chia FS 1973. Killing of marine larvae by Diesel oil. *Mar Poll Bull* 4: 29-30.

Cohen Y, Nissenbaum A, Eisler R 1977. Effects of Iranian crude oil on the Red Sea Octocoral *Heteroxenia fuscescens. Environ Poll* 12: 173-186.

Coles SL, Fadlallah YH 1990. Coral survival and mortality at low temperatures in the Arabian Gulf: New species-specific lower temperature limits. *Coral Reefs* 9: 231-237.

Coles SL, Jokiel PL 1991. Effects of salinity on coral reefs. *In* Connell DW & Hawker DW eds, Pollution in Tropical Systems. CRC Press, Florida: 147-166.

Cook CB, Knap AH 1985. Effects of crude oil and chemical dispersants on the photosynthesis of the brain coral *Diploria strigosa. Mar Poll Bull* 78: 21-27.

Cormack D 1983. Response to oil and chemical pollution. Applied Science Publishers, London.

Cormack D 1999. Response to marine oil pollution – review and assessment. Kluwer Academic Publishers , 345 p.

Corredor JE, Morell JM, del Castillo CE 1990. Persistence of spilled crude oil in a tropical intertidal environment. *Mar Poll Bull* 21: 385-388.

Dodge RE, Wyers SC, Frith HR, Knap AH, Smith SR, Sleeter TD 1984. The effects of oil and oil dispersants on the skeletal growth of the hermatypic coral *Dilporia strigosa. Coral Reefs* 3:191-198.

Dodge RE, Knap AH, Wyers SC, Firth HR, Sleeter TD, Smith SR 1985. The effect of dispersed oil on the calcification rate of the reef-building coral *Diploria strigosa. In* Proceed 5th Intern Coral Reef Sympos 6: 543-457.

Dodge RE, Baca BJ, Knap AH, Snedaker SC, Sleeter TD 1995. The effects of oil and chemically dispersed oil in tropical ecosystems: 10 years of monitoring experimental sites. MSRC Tech Rep Ser 95-014. Washington, DC: Marine Spill Response Corporation, 93 p.

Downing N, Roberts CM 1993. Has the Gulf War affected coral reefs of the northwestern Gulf? *Mar Poll Bull* 27: 149-156.

Ducklow HW 1977. Influence of sublethal pollutant concentrations on the microbial ecology of living corals. PhD thesis, Harvard Univ, Cambridge, Massachusetts.

Ducklow HW, Mitchell R 1979. Bacterial populations and adaptations in the mucus layers on living corals. *Limnol Oceanogr* 24: 715-725.

Eakin CM, Feingold JS, Glynn PW 1993. Oil refinery impacts on coral reefs: health, hazards and history. Rosenstiel School of Marine and Atmospheric Sci, Univ Miami, Coral Gables: 43-49.

Eisler R 1975. Toxic, sublethal and latent effects of petroleum of Red Sea macrofauna. *In* Proc 1975 Conf Prevention and Control of oil pollution. Am Petroleum Inst, Washington, DC: 535-540.

Elgershuizen JHBW, De Kruijf HAM 1976. Toxicity of crude oils and a dispersant to the stony coral *Madracis mirabilis*. *Mar Poll Bull* 7: 22-25.

Epstein N, Bak RPM, Rinkevich B 2000. Toxicity of third generation dispersants and dispersed Egyptian crude oil on Red Sea coral larvae. *Mar Poll Bull* 40 (6): 497-503.

Fadlallah YH 1983. Sexual reproduction, development and larval biology in scleractinian corals. A review. *Coral Reefs* 2: 129-150.

Farrington JW 1989. Bioaccumulation of hydrophobic organic pollutants compounds. *In* Ecotoxicology: problems and approaches. Levin SA, Harwell MA, Kelly JR, Kimball KD eds. Springer: 279-313.

Friaz-Lopez J, Zerkle AL, Bonheyo GT, Fouke BW 2002. Partitioning of bacterial communities between seawater and healthy, black band diseased and dead coral surfaces. *Appl Environ Microbiol* 68: 2214-2228.

Fucik KW, Bright TJ, Goodman KS 1981. Restoration of habitats impacted by oil spills Symposium, Blacksburg, VA (USA) 9-11 Nov 1981. Restoration of habitats impacted by oil spills, Cairns J, Buikema ALeds: 115-134.

Garrett P, Ducklow H 1975. Coral diseases in Bermuda. *Nature* 253: 349-350.

Green A, Burgett J, Molina M, Palawski D, Gabrielson P 1997. The impact of a ship grounding and associated fuel spill at Rose Atoll National Wildlife Refuge, American Samoa. Honolulu: US Fish Wildlife Serv, Pacific Islands Ecoregion, 60 p.

Gupta RS, Kureishy W 1981. Present state of oil pollution in the Northern Indian Ocean. *In* UNEP/IUCN (1988). Coral Reefs of the World. Vol 2: Indian Ocean, Red Sea and Gulf. UNEP Regional Seas Directories and Bibliographies. IUCN, Gland, Switzerland and Cambridge, U.K./UNEP, Nairobi, Kenya. 1+389 p, 36 maps.

Guzmán HM, Jackson JBC, Weil E 1991. Short-term ecological consequences of a major oil spill on Panamanian subtidal reef corals. *Coral Reefs* 10: 1-12.

Guzmán HM, Holst I 1993. Effects of chronic oil-sediment pollution on the reproduction of the Caribbean reef coral *Siderastrea siderea*. *Mar Poll Bull* 26 (5): 276-282.

Guzmán HM, Jackson JBC, Holst I 1993. Changes and recovery of subtidal reef corals. *In* Keller BD, Jackson JBC eds, Long-term assessment of the oil spill at Bahia Las Minas, Panama, synthesis report, Vol. II, tech rep U.S. Depart Interior, Minerals Manag Serv, Gulf of Mexico OCS Region, New Orleans: 361-446.

Guzmán HM, Burns KA, Jackson JBC 1994. Injury, regeneration and growth of Caribbean reef corals after a major oil spill in Panama. *Mar Ecol Prog Ser* 105: 231-241.

Harrison PL, Babock RC, Bull GD, Oliver JK, Wallace CD, Willis BL 1984. Mass spawning of reef corals. *Science* 223: 1186-1189.

Harrison PL, Collins JC, Alexander CG, Harrison B 1990. The effects of fuel oil and dispersant on the tissues of a staghorn coral *Acropora formosa*: a pilot study. *In* Proceed 2nd Nat Workshop on the role of scientific support co-ordinator. 26-30 March 1990.

Harrison PL 1994. The effects of oil pollutants on fertilization and larval settlement in the scleractinian reef coral *Acropora tenuis*. *In* Proceed of Joint Scientific Conf Sci management and Sutainability of Marine Habitats in the 21st century. Townsville, Australia.

Haynes D, Johnson JE 2000. Organochlorines, heavy metals and Polycyclic aromatic Hydrocarbons in the great barrier reef (Australia) environment: a review. *Mar Poll Bull* 41: 267-278.

International Maritime Organization (IMO) 1997. Field Guide for Oil Spill Response in Tropical Waters. IMO 1997, 54 p.

International Petroleum Industry Environmental Conservation Association (IPIECA) 1992. Biological Impacts of oil pollution: coral reefs. IPIECAReport Series, Vol. 3. 1992.

International Tanker Owners Pollution Federation (ITOPF) 2006. Historical Data. http://www.itopf.org/stats.html

International Tanker Owners Pollution Federation (ITOPF) 2006. Clean-up techniques. http://www.itopf.org/clean-up.html

Jackson JBC 1986. Dispersal and distribution of clonal and aclonal benthic invertebrates. *Bull Mar Sci* 39: 588-606.

Jackson JBC, Cubit JD, Keller BD, Batista V, Burns K, Caffey HM, Caldwell RL, Garrity SD, Getter CD, Gonzalez C, Guzmán HM, Kaufman KW, Knap AH, Levings SC, Marshall MJ, Steger R, Thompson RC, Weil E. 1989. Ecological effects of a major oil spill on Panamanian coastal marine communities. *Science* 243 (4887): 37-44.

Johannes RE 1967. Ecology of organic aggregates in the vicinity of a coral reef. *Limnol Oceanogr* 12: 189-195.

Johannes RE, Maragos JE, Coles SL 1972. Oil damages corals exposed to air. *Mar Poll Bull* 3: 29-30.

Knap AH, Solbakken JE, Dodge RE, Sleeter TD, Wyers SJ, Palmork KH 1982. Accumulation and elimination of (9-14C) Phenanthrene in the reef-building coral (*Diploria strigosa*). *Bull Environ Contam Toxicol* 28: 281-284.

Knap AH, Wyers SC, Dodge RE, Sleeter TD, Frith HR, Smith SR, Cook CB 1985. The effects of chemically and physically dispersed oil on the brain coral *Diploria strigosa*. 1985 Oil Spill Conf, Publ 4385. Am Petroleum Inst, Washington, DC: 547-551.

Knudsen JW 1967. *Trapezia* and *Tetralia* (Decapoda, Brachyura, Xanthidae) as obligate ectoparasites of Pocilloporid and Acroporid corals. *Pacif Sci* 21: 51-57.

Kushmaro A, Henning G, Hofman DK, Benayahu Y 1997. Metamorphosis of *Heteroxenia fuscescens* planulae (Cnidaria: Octocorallia) is inhibited by crude oil: a novel short term toxicity bioassay. *Mar Env Res* 43 (4): 295-302.

LeGore S, Marszalek DS, Danek LJ, Tomlinson MS, Hofmann JE, Cuddebak JE 1989. Effect of chemically dispersed oil on Arabian Gulf corals: A field experiment. *In* Proceed 1989 Intern Oil Spill Conf, San Antonio, February 13-16, 1989: 375-381.

Lewis JB 1971. Effects of crude oil and oil spill dispersant on reef corals. *Mar Poll Bull* 2: 59-62.

Lewis JB 1978. Feeding mechanisms in black corals (Antipatharia). *J Zool* 186: 393-396.

Littler MM, Littler DS 1996. Black band disease in the South Pacific. *Coral Reefs* 15: 20.

Loya Y 1976. Recolonization of Red Sea corals affected by natural catastrophes and man-made perturbations. *Ecology* 57: 278-289.

Loya Y, Rinkevich B 1977. Effects of oil pollution on coral reef communities. *In* DR Stoddart, RW Grigg eds. Coral reef ecosystem under stress. Academic Press, London.

Loya Y, Rinkevich B 1979. Abortion effect in corals induced by oil pollution. *Mar Ecol Prog Ser* 1: 77-80.

Loya Y, Rinkevich B 1980. Effects of oil pollution on coral reef communities. *Mar Ecol Prog Ser* 3: 167-180.

Loya Y, Rinkevich B 1984. Effects of petroleum hydrocarbons on corals. *In* Human Impacts on Coral Reefs: facts and recommendations. Salvat B ed. Antenne Museum EPHE, French Polynesia, 1987.

Maragos JE 1994. Reef and coral observations on the impact of the grounding of the longliner Jin Shiang Fa at Rose Atoll, American Samoa. Honolulu: US Fish and Wildlife Serv, Pacific Island Office, 27 p.

Mercurio P, Negri A P, Burns KA, Heyward AJ 2004. The ecotoxicology of vegetable versus mineral based lubricating oils: 3-Coral fertilization and adult coral. *Environ Poll* 129: 183-194.

Merlin FX ed. 2005. Traitement aux dispersants des nappes de pétrole en mer. Guide opérationnel du CEDRE.

Mitchell R, Chet I 1975. Bacterial attack of corals in polluted sea water. *Microb Ecol* 2: 227-233.

Negri A P, Heyward AJ 2000. Inhibition of fertilization and larval metamorphosis of the coral *Acropora millepora* by petroleum products. *Mar Poll Bull* 41 (7-12): 420-427.

NOAA 2001. Oil spills in coral reefs: planning and response considerations. http://response.restoration. noaa.gov./oilaids/coral/reports.html. National Oceanic and Atmospheric Administration ed, report 2001 (revised in 2003).

Oil Spill Intelligence Reports (OSIR) 1999. Oil Spill risks in Latin America and Caribbean Region. White Paper Ser, Techn Statist Anal Cutter Information Corp, September 1999.

Palmork KH, Solbakken JE 1980. Accumulation and elimination of radioactivity in the Norway Cobster (*Nephrops norvegicus*) following intragastric administration of [9-^{14}C]phenanthrene. *Bull Environ Contam Toxicol* 25: 668-671.

Palmork KH, Solbakken JE 1981. Distribution and elimination of [9-^{14}C]phenanthrene in the horse mussel (*Modiola modiolus*). *Bull Environ Contam Toxicol* 26: 196.

Pandolfi JM, Bradbury RH, Sala E, Hughes T P 2003. Global trajectories of the long-term decline of coral reef ecosystems. *Science* 301: 955-958.

Peters EC, Philip AM, Yevich PP, Blake NJ 1981. Bioaccumulation and histopathological effects of oil on a stony coral. *Mar Poll Bull* 12 (10): 333-339.

Price ARG 1998. Impact of the 1991 Gulf War on the coastal environment and ecosystems: current status and future prospects. *Environ Int* 24 (1/2): 91-96.

Ramade F 1995. Eléments d'écologie : écologie appliquée, 5th ed, Ediscience International, Paris, 1995.

Ramade F 2000. Dictionnaire encyclopédique des pollutions. Ediscience International, Paris, 1999, 640 p.

Ramade F 2005. Asie du Sud-Est: un cataclysme prémonitoire. *Courr Nat* 218: 18-26.

Ramade F, Roche H 2006. Ecotoxicological impingement of pollutants on coral reefs: a review. *Rev Ecol Terre Vie* 61 (1): 3-33.

Readman JW, Tolosa I, Law AT, Bartocci J, Azemard S, Hamilton T, Mee LD, Wagener A, Le Tissier M, Roberts C, Downing N, Price ARG 1996. Discrete bands of petroleum hydrocarbons and molecular organic markers identified within massive coral skeletons. *Mar Poll Bull* 32 (5): 437-443.

Reimer AA1975. Effects of crude oil on corals. *Mar Poll Bull* 6: 39-43.

Richman S, Loya Y, Slobodkin LB 1975. The rate of mucus production by corals and its asimilation by the coral reef copepod *Acartia negligens*. *Limnol Oceanogr* 20: 918-923.

Rinkevich B, Loya Y1977. Harmful effects of chronic oil pollution on a Red Sea coral population. *In* Proceed 3rd Intern Coral Reef Sympos: 585-591.

Rinkevich B, Loya Y 1979. Laboratory experiments on the effects of crude oil on the Red Sea coral *Stylophora pistillata*. *Mar Poll Bull* 10: 328-330.

Sadiq M, McCain JC 1993. The Gulf War aftermath: An environmental tragedy. Dordrecht: Kluwer Academic Publishers, 1993.

Saenger P1994. Aftermath of an oil spill. *Search* 25 (1): 19-22.

Salvat B 2005. Les récifs coralliens: réalité et espoirs. *Courr Nat* 219:18-27.

Shinn EA 1972. Coral reef recovery in Florida and in the Persian Gulf. Report to Environmental Conservation Department, Shell Oil Comp. Houston, Texas.

Solbakken JE, Palmork KH, Neppelberg T, Scheline RR 1979. Distribution of radioactivity in coalfish (*Pollachius virens*) following intragastric administration of [9-14C] phenanthrene. *Bull Environ Contam Toxicol* 23: 100-103.

Southward, AJ 1982. The long-term effects of oil pollution on marine populations, communities and ecosystems, London, (UK), 28-29 Oct 1981. *Philos Trans R Soc Lond* Ser B 1982 297 (1087): 241-255.

Spooner M 1970. Oil spills in Tarut Bay, Saudi Arabia. *Mar Poll Bull* 1: 166-167.

Stainken DM 1975. Preliminary observations on the mode of accumulation of No. 2 fuel oil by the soft shell clam *Mya arenaria* L. *In* Proceed conf on prevention and control of oil pollution. Am Petroleum Inst, Washington, DC: 463-468.

Stirling HP 1977. Effects of a spill of marine Diesel oil on the rocky shore fauna of Lamma Island, Hong Kong. *Environ Poll* 12: 93-117.

Straughan D 1972. Factors causing environmental. changes after an oil spill. *J Petrol Technol* 24: 250-254.

Thorhaug A, McFarlane J, Carby B, McDonald F, Anderson M, Miller B, Gordon V, Gayle P 1989. Dispersed oil effects on tropical habitats: Preliminary laboratory results of dispersed oil testing on Jamaica corals and seagrass. 1989 Oil Spill Conf. Publ 4479, Am Petroleum Inst, Washington, DC: 455-458.

Vogt HP 1995. Coral reefs in Saudi Arabia: 3.5 years after the Gulf War oil spill. *Coral Reefs* 14: 271-273.

Ward GA, Baca B, Cyriacks W, Dodge RE 2003. Continuing long-term studies of the TROPICS oil and dispersed oil spill sites. 2003 Intern Oil Spill Conf.

Wilkinson C ed 2004: Status of Coral Reefs of the World: 2004. Australian Institute of Marine Science, 557 p.

Woodley JD, Chornesky EA, Clifford PA, Jackson JCB, Kaufman LS. Knowlton N, Land JC, Pearson MP, Wulff JL, Curtis ASG, Dallmeyer MD, Jupp BP, Koehl MAR, Neigel J, Sides EM 1981. Hurricane Allen's impact on Jamaican coral reefs. *Science* 214: 749-755.

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Ixtoc I: A Case Study of the World's Largest Oil Spill

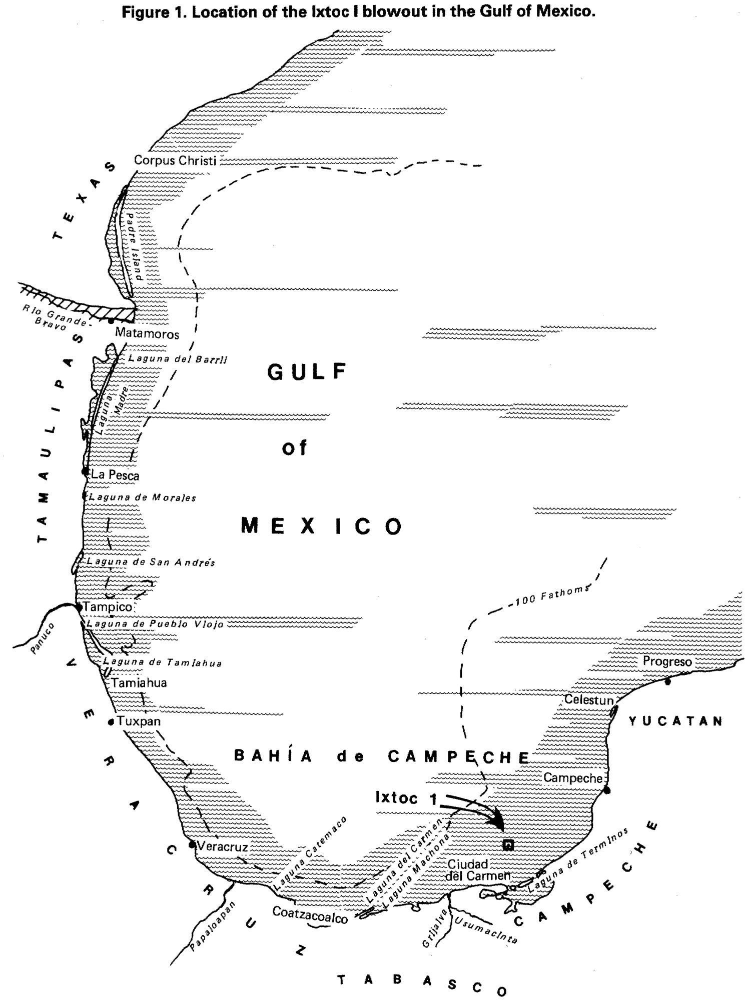
BY ARNE JERNELÖV AND OLOF LINDÉN

On June 3, 1979, the Ixtoc I exploratory well in the Bay of Campeche, blew out. It was finally capped on March 23, 1980, 290 days later, but during that time 475 000 metric tons of oil were spilled into the waters of the Gulf of Mexico. The full extent of the damage is still unknown.

On December 10, 1978, Petróleos Mexicanos (PEMEX) started to drill the Ixtoc I exploratory well at longitude 92°13′W and latitude 19°24′N, about 80 kilometers north-west of Ciudad del Carmen in the Bahia de Campeche (Figure 1). The water depth at the site is about 50 m. The drilling continued through the first part of 1979 and by the end of May a depth of 3600 meters had been reached. Early on June 2 at a depth of 3615 meters, the well started to loose drilling mud; circulation was totally lost about 3625 meters. Several unsuccessful attempts were made to regain circulation, but as the well appeared stable, it was decided to seal it by withdrawing the drill pipe and inserting a plug in the empty space. On June 3, during the attempts to seal the well, the extremely high pressure (about 350 kg/cm^2) caused mud to flow up the drill pipe and onto the platform. At 3:30 am the well blew out and caught fire. The explosion and fire destroyed the platform, which sank to the bottom and damaged the stack and well casing. This allowed the oil and gas to mix with water close to the sea floor, beginning the largest marine oil spill in the history of oil exploration.

Initially the spill was estimated to be about 4500 metric tons per day. However, by the beginning of August the well had lost over 225 000 metric tons—more oil than had been lost in any previous accident involving offshore drilling or transportation. When the well was finally capped on March 23, 1980—290 days after the blow-out—a total of about 475 000 metric tons of oil had been lost, according to PEMEX estimates (1).

Figure 1. Location of the Ixtoc I blowout in the Gulf of Mexico.



Figures 2a and b. The blowout as seen from a helicopter. Wind and current carried the oil in a north westerly direction. The rig in the foreground (left above) is a relief drilling platform. 2b on opposite page is a close-up of 2a. All photos: Olof Lindén.

The oil that was lost during the blowout polluted a considerable part of the offshore region in the Gulf of Mexico as well as much of the coastal zone, which consists primarily of sandy beaches and barrier islands often enclosing extensive shallow lagoons. A number of studies were intitiated to assess the extent of the damage. One of these was set up by the United Nations Environment Program (UNEP) at the request of the Mexican government. A summary of the results of that study (2), which focussed mainly on the acute impact of the spill, is reported here.

GENERAL BEHAVIOR OF THE OIL

The oil from Ixtoc I reached the ocean at a depth of 51 m and was injected into the water initially at a pressure of 350 kg/cm^2.

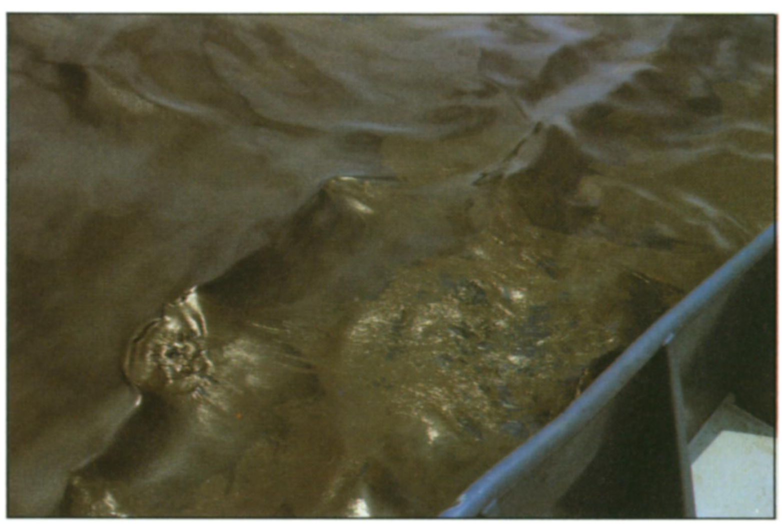


Figure 3. A thick layer of "chocolate mousse" close to the blowout.

Figure 4. Booms and skimmers in operation. In the background can be seen another relief drilling platform.

The oil was saturated with gas and consequently hit the surface as a three-phase emulsion, water droplets and gas bubbles in oil, with a water content of about 50 percent. Due to the high pressure at which the emulsion was formed the droplets were small. Most of the gas was burned as it emerged but only a very small fraction of the emulsified oil was actually burned (Figure 2 a, b).

The oil was of a light type. Thus, a high proportion consisted of straight-chain and cyclic hydrocarbons with less than sixteen carbon atoms, both comparatively volatile and water-soluble. During the first part of the blow-out, the emulsified oil formed a surface layer 1–4 cm thick, 0.7–5 km wide and about 60 km long (see Figure 3).

The initial formation of an emulsion resulted in the oil from the blow-out having

less contact surface with the atmosphere and more contact surface with the ocean water, compared with oil discharged on the water surface. Thus, considering its chemical composition, a larger part of the Ixtoc oil was dissolved in the water and a smaller part evaporated to the atmosphere when compared to other spills.

As the lighter fractions of the oil were lost through evaporation and dissolution, and as the gas bubbles left the emulsion, the remaining part gradually became heavier. As more and more water was incorporated in the emulsion, it gradually changed from water droplets emulsified in oil to oil droplets emulsified in water. Owing to their surface stickiness, the oil droplets accumulated particles from the water and thus gradually increased in density. Micro-organisms attached themselves to the droplets and zooplankton filter-feeders consumed both the droplets and the microorganisms, incorporating the oil residues in faecal pellets that increased the sinking rate of the oil. As the droplets increased in density, they gradually sank through the water column. In the Gulf of Mexico there is a stratification in the watermass due to temperature and/or salinity. This stratification is partly caused by the influx of fresh water via rivers and lagoons. There are indications that parts of the Ixtoc I oil sank in droplets through the less dense surface water and temporarily accumulated and floated on the strata with higher density. Eventually the oil increased in density and sank through the denser water strata. If the stratification was broken up due to wave action or changes in temperature, oil floating on the sub-surface layer could again reach the surface.

When it reached a beach, the oil was either deposited there, or made to sink in the shallow water, weighed down by the particulate matter in the zone where the waves broke. The oil on the beach was exposed to sunlight that raised its temperature and intensified weathering. It formed tarlike balls or cakes with little stickiness.

FATE OF THE OIL

From the start of the blow-out on June 3, 1979, to the final capping on March 23, 1980, a total of about 475 000 metric tons of oil was lost (1). Various attempts were made to stop the blow-out, and they gradually reduced the flow-rate of oil (Table 1).

Based on data from the Ixtoc I case, analogies with other oil spills and data in the literature, an attempt has been made to estimate the fate of the oil from Ixtoc I (Table 2). The emulsification brought down the amount of oil that was burned at the well site. The authors estimate that only a very small fraction of the oil, probably less than 1 percent, was actually disposed of when the gas was burned at the well. However PEMEX estimates that about 50 percent of the spilled oil burned at the well site (3).

Mechanical recovery in the Ixtoc zone removed 10 000 metric tons, about 4–5 percent (3). Evaporation, judging by data in the literature and experiments with the actual oil which took into account its physical and chemical characteristics, could have removed 45–70 percent. The initial emulsification was likely to result in an actual figure in the very low part of that range.

The fraction that went into solution in sea water was generally considered small. It seems likely that less than 100 ppm was actually dissolved and therefore the total amount is insignificant in this context.

Again taking data in the literature as a basis, it is thought that biological degradation, together with photochemical and chemical breakdown during the acute phase of the spill, would account for 10–15 percent of the oil.

The oil on Mexican beaches that the authors observed in early September was calculated to be about 6000 metric tons. Most of it had landed during the preceding four or five days. Based on reports from various groups and individuals, five times that figure is thought to represent a fair estimate of what had landed on Mexican beaches.

Investigations along the Texas coast show that approximately 4000 metric tons of oil or less than 1 percent was deposited there (4). The rest of the oil, about 120 000 metric tons or 25 percent, sank to the bottom of the Gulf.

THE CLEAN-UP

Ixtoc area

Operations to combat the oil within the Ixtoc I area were conducted from several auxiliary ships and barges. For confinement of the oil, high sea booms were anchored in fixed positions attached to the barges (Figure 4). For recovery of the oil, skimmers and absorbent devices were used (see Figure 4).

The recovery operations started in the late part of June and were cancelled in early October. The theoretical pick-up capacity of the equipment used was about 20 percent of the total outflow, but a number of obstacles meant that only 4–5 percent of the oil was actually recovered. One major problem was the weather. At wave heights higher than 3 to 4 meters the equipment was not operable at all; and the wind speed during the fall and winter in particular frequently caused wave heights higher than that. Another major problem was that it was not considered feasible to operate the system at night. A third limitation was the difficulty of rearranging the barges and booms as winds and currents changed. This caused part of the oil to drift past each side of the boom configurations. And finally, the oil-collecting equipment used broke down on a number of occasions.

In order to protect the lagoons from being contaminated by oil, booms were placed across most of the inlets along the coast. Because of the way the booms were deployed, however, they were seldom effective (Figure 5). Frequently the current passing through the inlets either ruptured the booms or pressed them under or over the water. As a boom is normally an effective barrier only at velocities below 0.7 knots at right angles to the boom skirt, the only way to use booms in most of the inlets would have been as deflectors placed at a comparatively narrow angle against the drifting direction. And the confined oil would have needed to be recovered using pumps or skimmers, without too much delay. This was not done.

On June 9 large-scale dispersant spraying commenced using specialized fixed-wing aircraft. The dispersants were initially sprayed in a zone 10 to 25 miles off the coast, but later, during the fall, dispersants were also sprayed close to the beaches, near the mouths of the lagunas, and around the well site. From late October dispersant spraying from boats gradually replaced spraying from aeroplanes. The exact quantity of dispersant used in the clean-up is not known. However, according to information received by PEMEX (3), at least 9000 metric tons were used. Of this, at least 6750 metric tons were Corexit products (5). This

Table 1. Oil released from Ixtoc I.

Period	Daily loss (metric tons)	Total accumulated loss
3 June–12 August	4 400	300 000
13 August–15 November	1 500	438 000
16 November–30 November	600	447 000
1 December–5 March	300	475 500
6 March–14 March	60	476 000

SOURCE: Reference 2.

Table 2. Fate of the Ixtoc I oil during the acute phase.

	Percent	Metric Tons
Burned at well site	1	5 000
Mechanically removed at well site	5	23 000
Evaporated to the atmosphere	50	238 000
Degraded biologically and (photo) chemically	12	57 000
Landed on Mexican beaches	6	29 000
Landed on Texas beaches	<1	4 000
Sank to the bottom	25	120 000

SOURCE: Ref. 2.

Figure 5. Attempts to prevent the oil from entering the lagunas using booms often failed because of strong currents.

means that the use of dispersant during the Ixtoc I blow-out was one of the largest in history.

About 30 000 metric tons, or about 6 percent of the oil from Ixtoc I, landed on the Mexican beaches of the Gulf (7). No clean-up at all was carried out over large areas. Here, the oil was left for natural degradation. However in some areas a type of clean-up technique was used that involved covering the contaminated sand with clean sand; bulldozers dug a trench some 1.0 to 1.5 meters deep and the oily sand was then shovelled into the trench and buried.

EFFORTS TO STOP THE FLOW OF OIL

In late June, about three weeks after the Ixtoc I blow-out, an unsuccessful capping attempt was made. The so-called blow-out preventer, which consists of valves situated on the well pipe over the sea floor, was closed. The valves were situated under the ruptured part of the pipe and had not been damaged by the blow-out. However, the capping failed due to the high pressure in the well, which caused oil and gas to leak outside the well casing below the blow-out preventer.

Several attempts were made to decrease the flow of oil from the well using large numbers of steel and lead balls with a weight of 1–2 kilograms each. The balls were forced into the well head but the high pressure of the leaking oil and gas ejected them. However, using this method a substantial reduction of the oil and gas flow was obtained in the middle of August when the flow rate decreased from 10 000 metric tons per day to about 4000 metric tons per day, according to PEMEX (4).

Next a funnel-shaped oil collection device a "sombrero", was placed over the well in another attempt to reduce the flow of oil. The Sombrero weighed about 310 tons in the air, was 12 meters wide and 6 meters high. It was positioned with its wide end down above the well head in the middle of October. The oil and gas contained under it was pumped through a flexible hose at the top to a platform. However due to logistic problems at the platform, only a minor part of the oil that could be recovered via the Sombrero was actually disposed of. In the early part of December rough seas damaged the device and it was removed from the well site.

The measure that finally capped the well on March 23 was the pumping of mud into the relief wells Ixtoc IA and IB. The drilling of these relief wells was started in the middle of June and the middle of July respectively. The first to be completed was the Ixtoc IB. A link between the relief well and Ixtoc I was established in December. However, it was necessary to complete the other relief well before the pressure was relieved. The Ixtoc IA reached the Ixtoc I formation in the second week of February. On March 23 the pressure of the mud that was pumped through the relief wells and into the formation finally reduced the flow of oil and gas to zero through the Ixtoc I well head. After this was done, the well was sealed with several cement plugs.

EXPOSED OR THREATENED ECOSYSTEMS

Offshore

The continental shelf, extending from the wide Campeche Bank in the east to the narrower but longer shelf in the west and north, is flat and covered by fairly uniform sediments. These bottom areas form highly favorable environments for diverse species of demersal fish, shrimps, molluscs, crabs and other invertebrates.

Little study has been devoted to the fish populations but it is believed that they have a commercial potential (biomass > 8 kg/hectare). However, at present they are not being exploited to a very great extent.

The shrimp populations on the continental shelf are large and commercially very important, especially on the Cam-

Figure 6. The crab populations along several hundred kms of coastline were almost totally wiped out by the Ixtoc I oil.

peche Bank and in the area of Tampico. The three major species are the pink shrimp, *Penaeus duorarum*, the white shrimp, *Penaeus setiferus*, and the brown shrimp, *Penaeus aztecus*.

The total biomass of shrimp on the Campeche Bank was measured in one area near the Ixtoc I well at about 4 kg/hectare. Of this, the white and pink shrimp comprised approximately 37.5 percent each, while the pink shrimp made up the remaining 25 pecent, though in fishery statistics the latter account for 80–90 percent of the catch on the bank. Since 1964, the actual catch has been close to 15 000 metric tons per year.

Less is known about the shrimp stocks in the area of Tampico, but the present catch (1979/80) has been roughly calculated by Pesca, the Mexican Department of Fisheries, at 6000 metric tons per year. Here the main species is *Penaeus aztecus*.

The pelagic ecology of the Gulf of Mexico is marked by high primary productivity caused by nutrient input from a number of large rivers discharging into it, and by upwelling that occurs in a number of places. Primary production near Veracruz has been measured at as high as 5 g C/m^2/day. Pelagic fish stocks are thought to be considerable, although only a few are fished commercially: bonito, mackerel, sardine and other clupeids.

Coastal Coral Reefs

There are two clusters of coral reefs along the western Gulf of Mexico, one situated north and east of Tuxpan, and the other east of Veracruz. The Tuxpan reefs form the most northerly cluster of reefs in the western part of the Gulf and are situated some 10–20 km from the coast.

The Tuxpan reefs generally have a semilunar shape, with their major axes orientated north-south. Maximum development of the reefs occurs in the south-east sections, suggesting a strong influence by

Figure 7. Large and frequent plankton blooms occurred after the blowout both off-shore and close to the beaches.

the dominant currents from the south-east and by the periodic destructive cyclones from the north. The reefs rise from a depth of some 25 m to not more than 1.5 m and some have sandy bays rising above the water level. The average tides are approximately 0.5 m and the maximum 1.0 m. The Veracruz reefs have more or less the same configuration as those near Tuxpan but occur in two distinct barrier formations away from the coast: an inner and an outer.

The structure of the reefs is roughly similar to that found throughout the tropical Atlantic, and the communities associated with them are the same. Ernesto Chavez has described the communities occurring at Lobos reef, located 65 km north-east of Tuxpan (6). Usually associated with the reefs are seagrass beds which harbor extremely rich and productive communities on the leeward side, protected against the open sea. These seagrass beds, dominated by *Thalassia* or turtle grass, act as nurseries for commercially important species of fish and crustaceans. For example, the pink shrimp (*Penaeus duorarum*), the grass shrimp (*Palemouetes pugio*), the spiny lobster, the mud crab (*Neopanope sp*), and molluscs such as *Lucina spp* and *Chione spp,* abound in this area.

Sandy beaches

The Gulf of Mexico has two characteristic types of sandy beaches. The first type along the entire western shore, are generally long and wide stretches of beach composed of fine- to medium-grained sediments of mixed calcareous origin. These are exposed to the open sea and are pounded by heavy waves. There are wide, active surf zones and gently sloping swash zones. The fauna of these sandy beaches is fairly constant in species composition but highly variable in numbers. The characteristic species is the beach clam *Donax* that makes its burrow above the swash zone but is active in both the swash and surf zones, especially during the night. Other species were present during the investigations but only *Donax* occurred in very large numbers (approximately 10 000/m^2 near Rio Bravo). It is well known that the Kemp Ridly turtle, which may be on the verge of extinction, has one of its few remaining nesting sites along the barrier beach at Rancho Nuevo near Tampico. In 1979, approximately 10 000 baby turtles were removed from their nests near the high-tide mark by conservationists and transported to the open sea to avoid the possibility of contamination by oil.

The second major sand beach type occurs along shorter stretches of the coastline, especially in the area between Ciudad del Carmen and Campeche. Here the beaches tend to be shorter, more cuspate, partly sheltered and composed of poorly sorted calcareous sediments and shells. They are frequently interrupted by rocky headlands and are much narrower than the barrier beaches. Prominent sand dunes are also absent. The fauna of these beaches is also poorly developed.

Human activity on the beaches varies with the nature of the beach and its proximity to towns and fishing areas. Along the western shore, the barrier beaches are used extensively for recreation near major population centers (*eg* Veracruz, Tuxpan, Tampico). However, away from these centers, the beaches are generally deserted, except for some fishing activity.

Rocky shores

Rocky shores are not very common along the Gulf of Mexico and are found chiefly in the area south of Campeche where they are formed from raised reefs and are exposed to the open sea. The fauna and flora of these rocky headlands are not very rich because of the high solar heat burdens. They are dominated by small gastropods and encrusting algae. Subtidally, the diversity increases greatly.

Mangroves

Mangrove forests occur along the coast from the town of Campeche to north of Celestun. They are comprised of the common western Atlantic species, *Rhizophora mangle* (red), *Avicennia nitida* (black), *Laguncularia racemosa* (white) and *Conocarous erectus* (button). The mangroves cover a wide zone inland from the water's edge (up to 30 km) and show the characteristic zonation pattern of these species. There is very little human penetration into these mangrove forests and thus it is suspected that the stands are mature and free from any destruction. Although the mangrove's fauna could not be carefully observed, it is safe to assume that their primary and secondary productivity is very high indeed and that migrating fauna, such as shrimp and finfish, use it as feeding grounds for part of their life cycle.

Coastal lagoons

The entire Mexican coast from Carmen to Rio Bravo is punctuated by a number of coastal lagoons of which the three largest and most important are the Laguna de Términos (Carmen), the Laguna de Tamiahua (between Tuxpan and Tampico) and the Laguna Madre (between Tampico and Matamoros). These lagoons are characterized by two features: each has one or more corridors to the sea through a narrow opening across the barrier beach, and each is relatively shallow (only a few meters at most). In some there are extensive intertidal mud and sand flats and all are biologically very productive.

The Laguna de Terminos has an area of about 1800 km^2 and two openings to the sea. Brown and white shrimp from the Campeche Bank spend the early part of their life cycle in this lagoon and juveniles are fished commercially. There are large populations of the oyster, *Crassostrea virginica* and the clam, *Rangia cuneata,* and both are exploited for commercial purposes. It is clear that the lagoon is of great importance to the shrimp stocks of the Campeche Bank and has a high potential for further fishery development.

The Laguna de Tamiahua has an area of about 700 km^2 with one opening to the sea at its southernmost point (Barra de Villarrea). It harbors dense populations of *Crassostrea virginica,* of which, according to the Pesca authorities, 25 000–30 000 metric tons are harvested annually by 3000 oyster fishermen. This lagoon is the major producer of oysters in Mexico and may also be its most productive. In addition to oysters, juvenile white shrimp and two species of *Mugil* are fished.

The Laguna Madre is a large complex system of inlets, enclosed or semi-enclosed lagoons, tidal flats, marshes and islands. Its total area is estimated at approximately 3200 km^2. Productivity is high and oysters and shrimp are fished by more than a thousand fishermen from villages and towns scattered around the lagoon. Bird life in the Laguna Madre seems the most abundant of all the lagoons, and several water birds (especially terns, gulls and the endangered brown pelican) nest and feed within the system.

Rivers

In addition to the Lagunas, which tend to be estuarine, there are several reasonably large rivers that discharge directly to the sea and have estuarine conditions near their mouths.

The interrelationships between the different offshore and coastal ecosystems are very important, as can be seen, especially for freshwater run-off and lagoon hydrology, nutrient condition and productivity in the Laguna de Términos. Similarly, freshwater run-off directly by the rivers and through the lagoons affects surface sea currents and productivity in the Campeche area and plays an important role in determining shrimp (and possibly some fish) migratory patterns. In addition the dependence of the commercially important brown and white shrimp, at different stages of their life cycles, on the marine and lagoonal systems is well known and demonstrate the integrated nature of these coastal ecosystems.

BIOLOGICAL IMPACTS OF THE OIL

In general, the oil from the Ixtoc I blowout acutely affected the species and ecosystems in the Campeche Bay area through its chemical toxicity (in the vicinity of the well) and through its physical

properties (stickiness) in a larger area offshore and along the coast. Thorough studies of the long-term biological effects of the spill have either not been carried out in Mexican waters, or the results of such studies are not yet available. A recently published study of the spill (8) does not provide any answers to this question either. Therefore we will discuss some of the effects the spill could theoretically have caused and give examples of direct observations of effects made by the authors in the field.

The commercially important species and ecosystems affected by the chemical toxicity of the oil were mainly the offshore shrimp and fish populations. Shrimp spawning in Campeche Bay may have been particularly affected. The pink and brown shrimps (*Penaeus duorarum, P aztecus*) have important spawning grounds south and east of Ixtoc I. The eggs, and more particularly the larvae, are known to be sensitive to petroleum hydrocarbons. When wind and current patterns changed in October, the oil slick moved south and south-east, thereby increasing the threat to these stages and possibly also to juveniles and adults. Laboratory experiments exposing larvae and adults of other crustaceans, including shrimp, to crude oil show that the acute toxicity levels are in the range of 0.1–10 ppm total oil. If we assume that 0.1 ppm was the acute toxic concentration (Ixtoc I oil is particularly rich in the highly toxic, low boiling aromatic fraction); a mixing depth of 25 m; a five-day persistency of the toxic oil fractions in the water solution; and a required concentration of 0.1 ppm to cause damage to shrimps, as well as to plankton or other pelagic organisms; then an area of 15 000 km^2 can be regarded as poisoned by the Ixtoc I oil. This is equal to 2.5 percent of the Mexican part of the Gulf.

The amount of oil that reached the bottom sediments of the Gulf is estimated to be of the order of 120 000 metric tons (see Table 2). Offshore, this oil was mostly in the form of small droplets, with larger aggregates sometimes forming nearer the shore. The average concentration over the entire area would have been below 1 g/m^2, which is not considered high enough to cause substantial damage to the benthic ecosystem. The shrimps' habit of burrowing in sediments and consuming them could have resulted in the uptake of petroleum hydrocarbons and tainting of the shrimps.

There was a lot of concern about the damage the oil might cause to the ecology of the shallow coastal lagoons. As it turned out however, very little oil was actually spread into the lagoons. It was prevented mainly by the water flowing out of them; a flow that was increased by the unusually heavy rains during this particular winter.

It is clear that the oil had a drastic impact on the littoral crab and on the mollusc fauna of the beaches which were contaminated. The populations of crabs, *eg* the ghost crab *Ocypode quadrata,* were almost totally eliminated over a wide area (Figure 6). The crab populations on coral islands along the coast were also reduced to only a few percent of normal about nine months after the spill. The abundant beach clams (*Donax*) as well as other molluscs of the sand beaches did not exhibit any drastic mortality following the spill.

In several places in the Veracruz area, such as on the coral island Isla Verde, dense mats of green algae were observed covering hard substrates such as corals and rock formations about 10 months after the blow-out. It seems likely that these effects were caused by repeated exposure to the oil, but it is still questionable whether they resulted from effects on the herbivores (mainly gastropods) or whether the sensitive balance between the algae and the coral polypes had been disrupted in some way. In the off-shore region there have been indications of an adverse impact on the base of the marine food-chains. Unusually large plankton blooms have been observed in the contaminated areas, possibly indicating eutrophication effects or that the zoo-plankton communities might have been damaged (Figure 7). This would very likely affect the exploitable populations of fish and shellfish.

Such large plankton blooms were observed north and west of Tampico in September 1979 and were very frequent on and around the Campeche Bank in the beginning of 1980.

Fishing was banned or restricted by the Mexican authorities in several severely contaminated areas north and south of Tampico in September. Fish and octopus catches reportedly dropped by 50–70 percent from the 1978 levels off Port Mansfield and Port Isabel, Texas, and off the Mexican coast from the US border south to La Pesca (9). The overall statistics for landing figures for 1979 and 1980 indicate that no decrease in the amount of fish and shellfish landed in Mexican harbors occurred, compared to figures for 1979 (10). However the fishery statistics are not a reliable indicator of damage to the fish populations. Shifts in landing places by individual boats, which are impossible to see in the statistics, may have drastic effects on the landing figures, and changes in foreign nations' fishery concessions would distort the figures on total catches. For example, Mexico excluded foreign fishing over her shrimp fishing grounds in 1979. Another shortcoming is that new species, previously not included in the statistics, may affect the total figures. For instance, octopus landings were included in the catch figures for the first time in the years following the blow-out. There are indications that all these factors have affected the figures for landings of fish in Mexican harbors, and therefore conclusive judgements based on statistics alone cannot be made. The actual extent of the damage caused by the world's biggest oil spill has yet to be determined.

References and Notes

1. According to Petróleos Mexicanos (PEMEX) official daily flow rate estimates, the total amount of oil lost from Ixtoc I was about 476 000 metric tons. The figures are quoted *eg* in Oil Spill Intelligence Report, March 28, 1980. However, after the final capping of the well, another figure (430 000 metric tons) was released by PEMEX as the total amount of lost oil.
2. This report is based on the findings of a mission to Mexico by the United Nations Environment Program (UNEP) with the co-operation of FAO, IMCO and IUCN. The mission had the following composition: A Jernelöv (Mission leader, UNEP), R Engdahl (IMCO), O Lindén (FAO), C Rees (UNEP) and B Wade (IUCN). The views expressed in this report are not necessarily shared by UNEP or the other UN agencies, nor by any of the governments involved.
3. Ing Garcia-Lara, Jefe de la oficina de Protección Ambiental, PEMEX, private communication.
4. E R Gundlach, K J Finkelstein, and J L Sadd. *Impact and persistence of Ixtoc I oil on the south Texas coast.* In Proceedings of the 1981 Oil Spill Conference, American Petroleum Institute, Washington DC, 1981, p 477–485.
5. Information given by G Lindblom in connection with the presentation of his paper at the 1981 Oil Spill Conference in Atlanta, Georgia, March 2–5, 1981.
6. Dr Ernesto Chavez, Jefe de Departamento de Ecologia, Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, Mexico City.
7. In early November, a covering of oil between 15 and 30 cm deep was reported from the western shore of the Yucatan from Ciudad del Carmen to Progresso. The report was made by the US Coast Guard (Oil Spill Intelligence Report, November 16, 1979).
8. Informe de los trabajos realizados para el control del Pozo Ixtoc I el combate del derrame de petróleo i determinasión de sus efectos sobre el ambiente marino. Programa Coordinado de Estudios Ecológical a la Sonda de Campeche 1980.
9. Oil Spill Intelligence Report, January 4, 1980.
10. Dr Carranza-Frazer, Director General del Instituto Nacional de Pesca, private communication.

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GulfofMexicoSPU

MC-252 Incident
SIMOPS Plan

1	4/29/2010	Final – Issued for Use	Geir Karlsen	Houston Incident Commander
0	4/28/2010	Final – Issued for Comments	Geir Karlsen	Houston Incident Commander
Rev	**Date**	**Document Status**	**Custodian/Owner**	**Authority**

Document	**Organization ID**	**Sector ID**	**Discipline ID**	**Document Class**	**Sequence Number**	**Document Revision**
Control Number	2200	T2	DO	PN	4001	1

AMENDMENT RECORD

Revision Number	Amender Initials	Date	Amendment
A	G. Karlsen	April 24, 2010	Initial draft.
B	K. Mouton	April 25,2010	Edits
C	G. Karlsen	April 27, 2010	Comments incorporated.
0	G. Karlsen	April 28, 2010	Comments incorporated, issued for use. Clarified and added comment to Section 1.3: Clarified section and added comment "Source Control SIMOPS Director covers an area of appr. 1,000-m from site". Added Sections 6.9 on Aviation and Section 6.10 on Helicopter Refueling. Added section 1.8 (HazID of operating in contaminated waters and added HazID documents. Updated contact details and general cleanup of doc. Added doc. number from Doc. Control.
1	G. Karlsen	April 29, 2010	Removed 1000-m radius circle from map Fig. 9 and updated with debris field.

REVIEWER SIGN-OFF			
	Name	**Signature (PLEASE PRINT)**	**Date**
Custodian/Owner	Geir Karlsen	GEIR KARLSEN	4-29-10
Reviewer (s)	BP Marine Assurance Rep	Daniel Polk	04-29-2010
	BP Geohazards Rep (AUV,HR2D)	ANDREW W HILL	4-29-10
	BP (IMT) Spill Operations	Dirk Smit	4/29/10
	BP Wells Rep	CHARLES HOLT	4/29/10
	BP (IMT) Safety Officer	Keith Mouton	4-29-10
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	USCG ~~On scene~~ Houma OPS		
	SIMOPS DIRECTOR	TROY ENDICOTT	4-29-10
Authorizer (s)	BP Discoverer Enterprise Lead	Dan Stoltz	4-29-10
	BP DD III Lead	[illegible] (George Gray)	29-Apr-10
	BP GoM Marine Authority	NCP	29-APR-10
	Transocean Incident Commander	[illegible]	29 APR -10
	BP Incident Commander	GARY IMM	29-APR-10
USCG	~~BP~~ On-Scene Commander	[illegible]	29 APR -10
	BP ON-SCENE COMMANDER	Mike Utsler	29-APR-2010

Note: No need for USCG Houma Ops. to sign off as per conversation USCG Commander Mark Shepard and Geir Karlsen on April 29, 2010.

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FIGURES

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1 Introduction

1.1 SIMOPS Plan Objectives

The goal of the MC-252 Incident Simultaneous Operations (SIMOPS) Plan is safe and efficient execution of the SIMOPS between all marine and aviation assets deployed in support of the spill and source control operations. The majority of the assets are provided or sourced by:

- Transocean Offshore Inc.
    - Development Driller III (DD III) semisubmersible
    - Discoverer Enterprise (DEN) drillship
- BP Logistics and Aviation (PHI, Chouest, Tidewater, VIH Cougar, Graham Gulf)
- Marine Spill Response Corp (MSRC)
- National Response Corp (NRC)
- Aker Marine
- Subsea 7
- Airborne Services Inc (ASI)
- USCG

The plan seeks to:

Inform members of the unified command involved in SIMOPS for the MC-252 Incident of the principles required for conducting simultaneous operations.

Identify the SIMOPS hierarchy for the major scopes of work between Spill Recovery, Well Control operations and drilling of relief wells.

Outline high-level procedural steps complimented by the detailed processes, procedures and plans (3P) issued by the respective groups. The 3P's are issued and reviewed in conjunction with Hazard Identification (HazID) assessments or planning meetings just prior to the SIMOPS event.

Concurrent operations onboard the assets described above are NOT covered or included in the SIMOPS Plan unless these activities affect other MC-252 Incident operations.

1.2 What Does Success Look Like?

Success is defined as zero SIMOPS clashes, zero SIMOPS impact to schedules and zero SIMOPS incidents. Getting to zero is only possible by strict discipline in the part of all stakeholders to adhere to the elements of the plan.

Remember: "Good SIMOPS is all in the communications."

1.3 The SIMOPS Team

SIMOPS Director - Overall responsibility for coordinating the execution of SIMOPS events. The SIMOPS Director resides in Houston.

Offshore Spill Operations SIMOPS Branch Director - Overall responsibility for coordinating the execution of Spill SIMOPS events. Position resides onboard Louisiana Responder.

Offshore Source Vessel Control SIMOPS Branch Director - Overall responsibility for coordinating the execution of Source Vessel Control SIMOPS events. Position resides offshore onboard the DD III or the Discoverer Enterprise. The Branch Director generally controls the areas inside the rigs 500-m zone and an area of appr. 1,000-m from the Macondo site. See **Figure 8**, page 35.

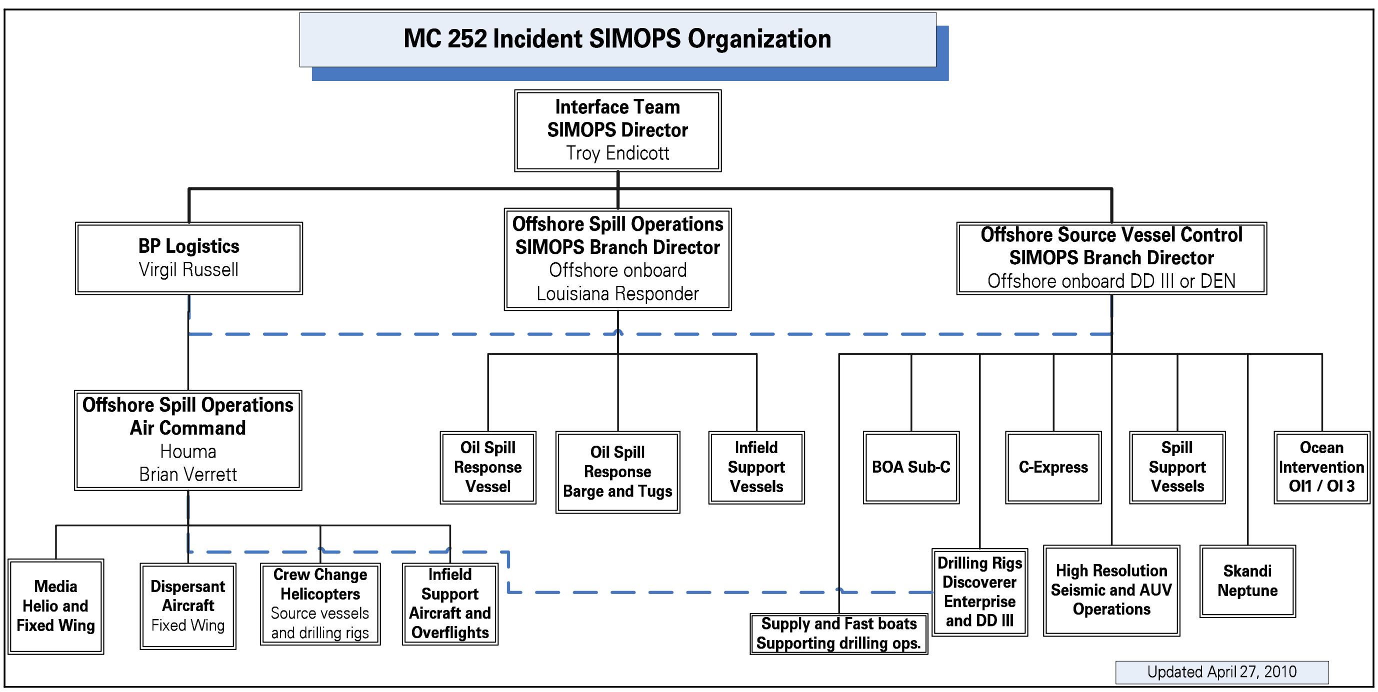
BP Logistics - Overall responsibility for providing air support to the project. Group resides in Houston.

Offshore Spill Operations Air command - Overall responsibility for coordinating and scheduling all aircrafts including fixed wing, crew change helicopters, dispersant deployments, over flights, recons and spotter planes. Position resides in Houma.

Vessel Person in Charge (VPIC) – Is the BP Vessel Rep. onboard. Can also be the OIM or the Well Site Leader. The VPIC is responsible for all Health, Safety, Security and Spill (HSSE) incidents. All incidents will be reported using the Notification scheme contained within the plan.

Note: Any person involved in a SIMOPS event has the authority and obligation to discontinue and shut down the SIMOPS event in the case of safety or operational concerns.

Figure 1: SIMOPS Communications Plan



SIMOPS events will be coordinated through daily SIMOPS call as per Section 2.5, page 14.

1.3.1 Onshore SIMOPS Director Responsibility

- Chair the daily SIMOPS call (see Section 2.5, page 14).
- Be the overall coordinator of SIMOPS activities at MC-252 Incident.
- Ensure SIMOPS events comply with HSSE guidelines.
- Identify need of SIMOPS HazIDs and SIMOPS reviews prior to a SIMOPS event.
- Assess potential schedule impact and associated risks from upcoming SIMOPS events.
- Liaison with leadership team on SIMOPS issues, scheduling and technical conflicts.
- Identify critical path and determine which operation has priority.
- Assess risks of single and multiple operations and SIMOPS events.
- Facilitate resolutions of any SIMOPS conflicts with the teams.
- Coordinate SIMOPS issues between the Discoverer Enterprise, DD III, Marine Activities and Aviation.

1.3.2 Offshore Spill Operations SIMOPS Branch Director Responsibility

- Be the overall coordinator of the execution of SIMOPS activities in the spill clean up operation.
- Direct vessels as per the daily operating plan.
- Identify resource needs.
- Liaison with the vessels in the cleanup fleet.
- Ensure spill cleanup SIMOPS events comply with HSSE guidelines.
- Assess potential schedule impact and associated risks and convey to the SIMOPS Director.
- Work with vessel Captain on all SIMOPS and HSSE.

1.3.3 Offshore Vessel Source Control SIMOPS Branch Director Responsibility

- Be the overall coordinator of the execution of SIMOPS activities in the fleet of source vessels.
- Area of responsibility is in the Macondo well area and the debris field out to appr. 1,000-m from site.
- Direct vessels as per the daily operating plan.
- Identify resource needs.
- Liaison with the source vessels.
- Ensure vessel activities comply with HSSE guidelines.
- Assess potential schedule impact and associated risks and convey to the SIMOPS Director.

1.3.4 Vessel Representative (VPIC)

Source control vessels and possibly some of the spill cleanup vessels will have a vessel rep. onboard. The vessel rep. responsibility is to:

- Implement specific programs concerning ROV, salvage, search and clean-up.
- Ensure HSSE and safety guidelines are followed onboard the vessel and in vessel ops.
- Provide guidance for the specific operation.
- Comply with operating procedures and applicable MC-252 Incident SIMOPS requirements.
- Work with vessel OIM or Captain on SIMOPS issues.
- Call-in on the daily SIMOPS call.

1.3.5 SIMOPS Interface Team (Member)

Assigned for each area of operations, such as well operations, ROV operations, spill clean-up, AUV and 2D Seismic surveying, Salvage and Recovery operations. The position resides onshore. Responsibilities are:

- Implement specific installation and construction programs.
- Arrange SIMOPS review meetings and HazIDs.
- Comply with operating procedures and applicable MC-252 Incident SIMOPS requirements.
- Establish communication plan between their SIMOPS supervisory personnel.
- Assist the MC-252 Incident SIMOPS Director in implementing the MC-252 Incident SIMOPS Plan.
- Provide progress report to the MC-252 SIMOPS Director.

1.4 Management of Change (MoC)

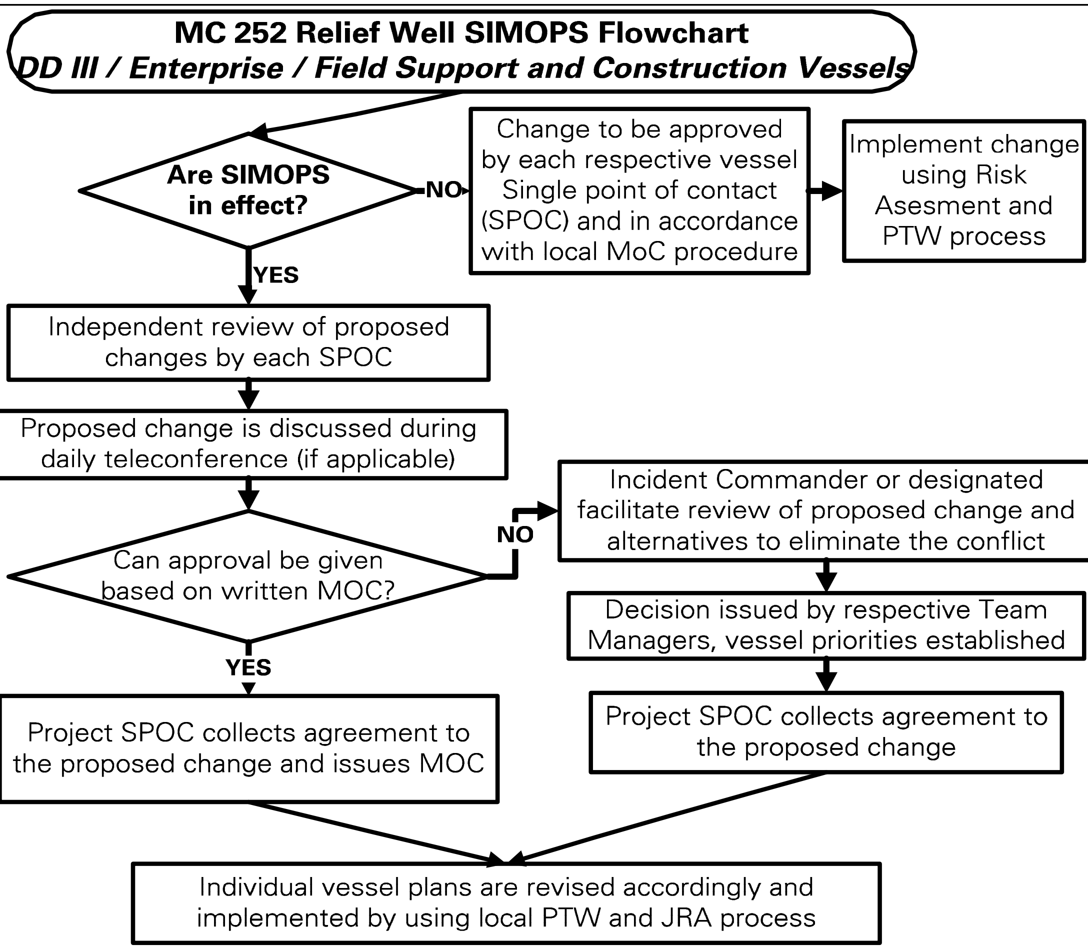
The MoC process is used in conjunction with changes to procedures and the SIMOPS schedule. Temporary and permanent changes are managed to ensure that health, safety, and spill risks remain at acceptable levels. The plan intends to exceed BP's Operations Management system (OMS), expectations, regulatory requirements and local needs.

Figure 2, page 11 shows the SIMOPS MoC procedure for changes in the MC-252 Incident program.

The GoM MoC process uses BizFlow found at the BP Intranet site:

http://gomdnc.bpweb.bp.com/bam/RP/Wiki%20Pages/Management%20of%20Change.aspx

Figure 2: MC-252 Incident SIMOPS MOC Process



Issue MoC

The approved GoM D&C Recommended Practice for Management of Change (MoC) is on the GoM D&C Sharepoint site under: Processes / Recommended Practices / Management of Change.
http://gomdnc.bpweb.bp.com/bam/RP/Wiki%20Pages/Management%20of%20Change.aspx

In this Recommended Practices Site, you will find the GoM D&C Recommended Practice for Management of Change as well as the link to the BizFlow tool, and a link to the MOC Quick Reference Guide.

Updated Apr. 27, 2010

1.5 HazID Assessing Operations in a Contaminated Environment

A HazID was held April 28, 2010 to assess the risks of the Discoverer Enterprise and the DD III being exposed to hydrocarbons either from a sheen or from a plume of oil. The HazID followed Trans Ocean's internal HazID the previous day.

There were no show stoppers identified during either HazID. The Operation Teams of the Discoverer Enterprise and the DD III were tasked with the assembly of an emergency disconnect plan should the direction of the plume change towards the rigs or should there be a catastrophic change to the volume of released hydrocarbons.

The HazID action items are found in Table 1 below.

Table 1: HazID Action Items

	Activity	Action	Responsible Person	Due Date
1	**Rig Operations**	Develop a decision matrix for various scenarios of increased oil flow that could impact the drill rig.	George Gray	
2		Include in IAP that source control immediately communicates any flow changes to the SIMOPS Director	Troy Endicott	Prior to ops.
3		Develop a model to predict plume location based on subsea currents. Consider the impact of rapidly increasing flow rate.	Troy Endicott	
4		Determine the location and density of oil/water emulsion / mousse floating below the surface.	Troy Endicott	
5		Convey IMT air monitoring and safety plan to the vessels.	Joe Neumeyer	Prior to ops.
6	**Other Operations**	Send 500 meter zone to branch directors.	Troy Endicott	Prior to ops.
7		Communicate to the IMT the drill rigs request to maintain a minimum of one mile distance for dispersant application or in situ burning.	Troy Endicott	Prior to ops.

The risk ranking and HazID results are found in Figure 11, page 41, Figure 12, page 43 and Figure 13, page 45.

2 Field Communications and Emergencies

2.1 Crisis Management

The Gulf of Mexico Deepwater Development (GoM DWD) Emergency Response Plan Guidelines are initiated should any emergency occur during a SIMOPS event. The SIMOPS event will be terminated or postponed until the emergency is cleared.

Any emergency onboard the Discoverer Enterprise, the DD III or associated vessels will be reported immediately to the other vessels and the Offshore SIMOPS Branch Director to ensure necessary precautions can be taken.

2.2 Severe Weather Contingency Plan

See GoM IMS Vol. III – Severe Weather Contingency Plan (see References in Section 7, page 48).

The Crisis Center at WL-4 handles the management of severe weather planning and field evacuation guidance.

2.3 Emergency Evacuation Plan

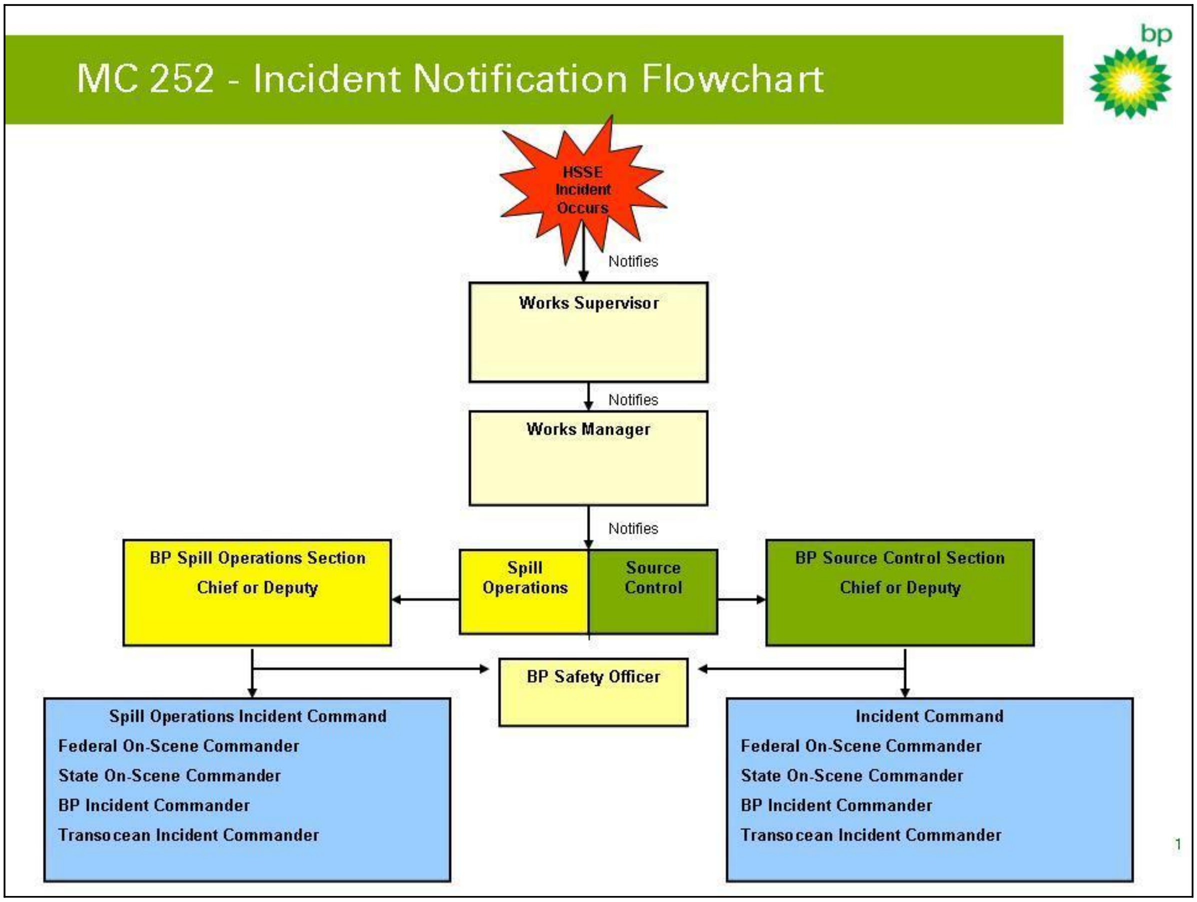
See GoM DWD Emergency Evacuation Plan (see References in Section 7, page 48).

2.4 Incident Notification

The Incident Notification Chart shown in Figure 3, page 14 is the main routing of incident notifications on the project.

It is recognized, however, that the MC-252 Incident operation is complex and that there is a possibility of incidents being reported through different channels.

Figure 3: Incident Notification Chart



2.5 Daily SIMOPS Conference Call

The SIMOPS Director chairs the daily SIMOPS conference call.

The following calls in to the SIMOPS call:

1. Each MC-252 Incident ROV and construction vessel
2. The lead spill clean-up vessel.
3. Houma IC.
4. Houston IC.
5. Discoverer Enterprise and DD III OIM and Well Site Leader (WSL) or designees.
6. BP vessel rep. and PIC on vessel(s) performing SIMOPS in the MC-252 Incident field.
7. Impact Weather and Horizon Marine (only if met-ocean conditions dictate).
8. Shore-based personnel as required

Work boats and fast boats are not required to participate.

The purpose of the daily SIMOPS conference call is to:

- Provide daily SIMOPS support to all MC-252 Incident groups.
- Get the latest met-ocean updates (Impact Weather and Horizon Marine to participate on an as-needed-basis).
- Ensure all activity centers are fully aware of ongoing and upcoming field activities and SIMOPS events.
- Review SIMOPS schedule issues.
- Ensure activities from outside operators (such as pipe-lay and seismic operations) are flagged.
- Review VHF and acoustics communication needs and clashing issues.
- Ensure the SIMOPS events are planned and executed according to the program with no impact to HSSE and minimum impact to other operations.

Table 2 below shows the details of the conference call center.

Participants call the Toll-free or the Toll numbers and then the Pass-code to get into the conference call.

Table 2: Conference Call Center

Dial-In Numbers and Pass Codes	Toll-Free number from inside USA:	1-866-634-1110
	Participant pass code:	925-727-0145

Each operation issues a daily SIMOPS report to the SIMOPS Director that is reviewed prior to the SIMOPS call. The report is a short synopsis of last 24-hours and the coming 24-hours utilizing Incident Action Plan (IAP).

The SIMOPS call agenda is:

- Met-ocean update (wind, waves and currents).
- Sheen, plume and marine debris update.
- Vessel Summary
  - Discoverer Enterprise – Current operations, SIMOPS events, next activity, special issues, Q&A.
  - DD III – Current operations, SIMOPS events, next activity, special issues, Q&A.
  - ROV vessels – Current operations, special issues, Q&A.
  - Construction and intervention vessels – Current operations, SIMOPS events, next activity, special issues, Q&A.
  - Barge and tugs – Update on current operations and next 24-hrs.
  - Spill clean-up vessels – Area of operation, sheen and plume update.
- SIMOPS issues, communications and VHF use, scheduling, conflicts and concerns.

2.6 SIMOPS Communication Guideline

Well-planned and established communications are keys to the successful execution of the MC-252 Incident SIMOPS. The SIMOPS Branch Directors must communicate with the respective Vessel Reps. / OIMs / Captains prior to the start of any SIMOPS activity and during the SIMOPS event as conditions require.

Remember: "Good SIMOPS is all in the communications."

2.7 Field Communications

2.7.1 Hailing Channels VHF 15 and VHF 16

Vessels approaching the field will use Channels 15 or channel 16 to call up the Discoverer Enterprise or the DD III Bridge. Channel selection, following the initial hailing is agreed upon with the respective installation.

Channel 15 and channel 16 are always monitored by the Discoverer Enterprise and the DD III. See Table 3, page 16.

Once the appropriate MC-252 Incident facility (Discoverer Enterprise or DD III) is hailed, the channel is switched to an agreed frequency as per Table 3. The table is a guideline and lists the agreed MC-252 Incident VHF channels. It is anticipated that radio noise and high usage may require selection of other channels at times.

The fleet of Source Control and Oil Spill Response vessels will work through the Onshore SIMOPS Director to establish field radio procedures and agree on channel selections.

Radio use and frequency selection will be part of the daily SIMOPS call.

Table 3 below shows the VHF hailing and the working channels for the MC-252 Incident field.

Table 3: VHF and UHF Working Channels

Location	Discoverer Enterprise	Discoverer Enterprise ROV	DD III	DD III ROV
Hailing general	**16**		**16**	**NA**
Bridge to Bridge	**15**		**13**	
Bridge to boat	**10, 11, 12**		**13**	
Port crane	**10, 11, 12**		**67**	
Starboard crane	**10, 11, 12**		**68**	
Crane to boat	**10, 11, 12**		**Port: 67, Stb. 68**	
Bulk and liq. Transfer	**8, 15**		**72, 88**	
ROV	**No radio**	**8**		**72, 88**
Discoverer Enterprise Bridge to maintenance	**64**	**NA**	**NA**	**NA**
Spare channels	**6, 69, 71, 73**		**6, 69, 71, 73**	
UHF	**2, 5, 9**		**3, 6, 9, 13**	**3, 6, 9, 13**
Helicopter	**123.05**		**122.700**	
Notes:	**Source control vessels and environmental cleanup vessels are hailed on ch. 15 and ch. 16**			
				Updated April 27, 2010

2.7.2 Radio

Vessels and aircraft, under contract to BP, are equipped with BP radios in addition to the contractor's communication equipment.

Operators of vessels involved in SIMOPS activities must agree upon *primary* and *secondary* radio communication frequencies prior to the start of any SIMOPS activity.

Note: Conduct radio check and confirm operability prior to start of any SIMOPS event.

2.7.3 Emergency Communications

For emergency response communication procedures and contact information, reference the "GoM DWD Emergency Response Plan" (see Section 7, page 48).

3 Acoustic Frequency Management and Position Referencing

The Acoustic Frequency Management Plan is summarized in Table 6, page 22 and in Figure 10, page 39.

Please note the following:

1. Horizon DP array transponders have been recovered and are not featured in the plan.
2. It is essential that all vessels with dual head HiPAP systems configure the system to track all transponders from a single head (all transponders tracked from the same head).

3.1 Enabling and Disabling of Transponders and Responders

The Dynamic Positioning Operator (DPO) onboard the Discoverer Enterprise and the DD III are responsible for the management and safe use of the acoustic frequencies at MC-252 Incident.

No acoustics will be turned on or off without the concurrence of the DPO onboard the Discoverer Enterprise and the DD III.

Warning:	**The Discoverer Enterprise and the DD III DPO will manage the acoustics in the MC-252 Incident field. There will be no enabling or disabling of acoustic channels without the DPO's concurrence.** **Do not change allocated channels without the concurrence of the Discoverer Enterprise and the DD III DPO. The main requirement of the Acoustic Management Plan is to prevent frequency clashing and risk interference or loss of acoustic position referencing for the Discoverer Enterprise and the DD III.**

Note that any noise issues degrading the acoustic position reference system *MUST* be reported to the OIM and the Well Site Leader. Under no circumstances should the acoustic system be disabled because of degraded signal to noise ratio. Disabling the acoustic system would bring the rig from a DP Class II to a DP Class I DP operation. **Note: TOI approval contingent on: "**acoustic system may be taken out of solution if degraded".

3.2 Safe Distance

The Frequency Management Plan assumes there is no safe distance where acoustics will not interfere, especially with the short distance between vessels. The plan produced a set of compatible channel allocations and guidelines that will allow each vessel to operate freely without concern as to the effect on other vessels nearby.

3.3 Echo Sounder Turnoff

Any vessels entering the MC-252 Incident area must turn off the echo sounders within 5-nm of arriving in the MC-252 Incident field. This is to ensure echo sounders do not create noise in the water column and

interfere acoustically with any of the vessels using acoustic communications. Do not turn on echo sounders until the vessel is outside this 5-nm limit.

Caution:	**Compliance with the echo sounder turnoff while in the MC-252 Incident field is mandatory.**

It is the responsibility of each MC-252 Incident group contracting vessels, the Logistics Group and the Fourchon Base to notify and inform the MC-252 Incident vessels of the Echo Sounder turnoff requirements.

3.4 Acoustic Frequency Coordination

3.4.1 Coordination of Acoustic Activities

All information, regarding the coordination of the MC-252 Incident Acoustic Frequency Management Plan, is directed to the respective rig's Team Leader.

Jonathan Davis with BP, Dave Ross with UTEC Survey, together with Kongsberg and Sonardyne, will assist in troubleshooting frequency clashes and interferences (see phone list for contact details).

3.5 Acoustic Equipment Use Notifications

Source vessels will work in close proximity to the Discoverer Enterprise and the DD III. These vessels must follow the Frequency Management Plan and the acoustic guidelines before enabling acoustic equipment.

3.5.1 Acoustic Field Operations

For acoustic operations at MC-252 Incident, vessels will inform the DEN and the DD III Bridge of arrival in the field. The following must take place prior to commencement of acoustic operations:

- Confirm field arrival and departure.
- Confirm all frequencies in use by the Discoverer Enterprise and the DD III as per Table 6, page 22.
- Confirm pre-approved acoustic channel allocations for the upcoming operation.
- Advise the Discoverer Enterprise and DD III of minimum proximity requirements between vessels.
- Advise the Discoverer Enterprise and DD III DPO when channels are enabled and disabled.
- Advise the Discoverer Enterprise and DD III DPO of source vessel channel selections.
- Be prepared to immediately disable acoustic channels in case of degradation of the Discoverer Enterprise and the DD III acoustic position reference systems.
- Discoverer Enterprise and DD III to advise vessel of any acoustic position reference system response and degradation from the added acoustics in the water column.

Caution:	No vessel shall deploy transponders without first contacting the DEN and the DD III DPO and receiving confirmation as to channels in use. The DEN and the DD III and any vessels using acoustics will be in continuous communications concerning acoustic noise and frequency clashing.

3.6 Fan Beam

Fan Beam is a position reference system used while vessels are in proximity. Workboats and supply boats, as well as vessels carrying out subsea construction, utilize Fan Beam. The system's maximum range is 2,000-m with an accuracy of $\pm$10 cm during optimum conditions. The system uses a laser beam and is, therefore, weather sensitive. The practical range for Fan Beam is in the range of 200-m to 400-m.

The key to a successful operation of the Fan Beam position reference system is to ensure the system is maintained, fully operational and in Green status and that the Fan Beam is set up according to the manufacturer's specifications.

Particular attention is required to the system setup. The gating parameters must be set correctly to ensure the intended target is followed. This may have been a problem in the past. There are known instances where the laser beam has locked onto a moving object onboard the adjacent vessel. The moving object may have been someone in coveralls with reflective tape.

Note: Any vessel working the MC-252 Incident area and using Fan Beam as a relative position reference system, must confirm that the system is operational according to manufacturer's specifications before the system is allowed to be used near the DEN, the DD III.

The Fan Beam User Guide v. 4.1 is listed as a reference in this document. *The user, however, shall always check with the manufacturer to ensure the correct and latest version of the user guide is utilized for setting up the Fan Beam systems on the particular vessel*.

The MC-252 Incident vessels have their Fan Beam laser units installed at different heights. Adjustments may be required in the height of the prisms installed on the Discoverer Enterprise and the DD III to conform to vessel requirements.

The Discoverer Enterprise and the DD III OIM should determine correct prism height and location based on communications with the respective user of Fan Beam systems. Table 4, page 20 lists the Fan Beam height for some vessels which may be used at MC-252 Incident.

Table 4: Fan Beam Height

MC-252 Incident Vessels	Fan Beam Height Above Sea Level	Ideal Reflector Height above Sea Level
		The reflector height is determined by the application and distance between vessels and is generally set at Fan Beam height -0 +17-ft.
Schlumberger DeepSTIM II	44-ft.	
Technip Deep Blue	102-ft.	
OI1	56-ft.	
OI3	74-ft.	
C-Captain	45-ft.	

There is a wide variation in Fan Beam installation heights between vessels. The Fan Beam prisms, installed on the DEN and the DD III, will require elevation and position changes, depending on which vessel is utilizing the system. Adjusting the height will improve the system performance and reduce Fan Beam positioning errors.

Table 5 below lists the MC-252 Incident vessels using Position Reference systems.

Table 5: Vessels using Position Reference Systems

MC-252 Incident Vessels	Available Position Reference System	Notes
Discoverer Enterprise	DGPS, Acoustics (Sonardyne digital)	DP Class II+
DD III	DGPS, Acoustics (HiPAP)	DP Class II+
Source control vessels	DGPS, Fan Beam and RADius. Acoustics for tracking and surveying	DP Class I and II Some vessels may not have been assessed for DP class
Spill clean-up vessels		Not assessed for DP class

3.7 RADius Position Reference System

The RADius position reference system measures relative distance between two adjacent vessels using the Doppler principle. The adjacent vessel is equipped with RADius transponder(s). The system has a range of approximately 1,100-m and is not affected by activities onboard the adjacent vessel. A transponder system consisting of a small box is installed onboard the host vessel (i.e., Discoverer Enterprise and DD III). The system requires a 120-volt power source. Range accuracy is 0.25-m.

Note: Any vessel, working the MC-252 Incident area and using RADius as a relative position reference system, must confirm that the system is operational according to manufacturer's specifications before the system is allowed used near the Discoverer Enterprise and the DD III.

Table 6: MC-252 Acoustic Allocation Summary

Vessel	Allocation
DD III DP	**DP** b31 DP b32 DP b35 DP b37 DP b73 DP b76 DP LIC
DD III	**ROV System** b14 Tracking b28 Tracking b34 Tracking b48 Tracking b54 Tracking b68 Tracking b74 Tracking
DO NOT USE	**b12** **b13** **b15** **b17** **b51** **b52** **b53** **b57** **b71** **b72** **b75**
Discoverer Enterprise DP array:	Sonardyne wideband Family 14, CIS. Ch. 1409, 1410, 1411, 1412, 1413
BOA SUB C	b18 SPARE b24 CRANE 1 b26 DP 1 b38 MILL 36 b46 SPARE b58 MILL 36 SPARE b64 CRANE 2 b78 MILL 37 b84 MILL 37 SPARE b86 DP 2
MISS GINGER	b27 Emergency AUV b42 AUV b47 SPARE b62 SEABIRD b67 SPARE b82 SPARE b87 SPARE
OI 3	b16 Tracking b23 Tracking b36 Tracking b43 Tracking b56 Tracking b63 Tracking b83 Tracking
SKANDI NEPTUNE	b21 Tracking b25 Tracking b41 Tracking b45 Tracking b61 Tracking b65 Tracking b81 Tracking b85 Tracking
OI-3	**Wideband Family 12 (see below)** Address 1201, CIS 1 ROV 1 Address 1202, CIS 2 ROV 1 Cage Address 1203, CIS 3 ROV 2 Address 1204, CIS 7 ROV 2 Cage
C-Express	**Wideband Family 15 (see below)** Address 1512, CIS 4 ROV Address 1513, CIS 5 ROV Backup Address 1514, CIS 6 ROV TMS

The acoustic allocations for all construction vessels are found in Figure 10, page 34, Figure 11, page 35 and Figure 12, page 35.

It is imperative that the plan is adhered to and that there are no changes without preapproval.

The DD III ROV channels may be utilized bby others if not required by the DD III operation.

CIC = Common Interrogation Signal

4 SIMOPS Events

4.1 SIMOPS Events

The SIMOPS plan contains multiple events and interfaces between the Discoverer Enterprise at relief well location RxC and DD III at relief well location RxD.

Anticipated SIMOPS events are:

- Discoverer Enterprise operating at relief well location RxC and DD III at relief well location RxD.
- Source control vessel activity inside the Discoverer Enterprise and the DD III 500-m exclusion zones.
- Source control vessel activity alongside the Discoverer Enterprise and the DD III.
- Spill clean-up vessel activity inside the Discoverer Enterprise and the DD III 500-m exclusion zones.
- Pumping vessel alongside Discoverer Enterprise or DD III.
- Salvage operations.
- Barge and tug boats.
- Aviation.
- In-situ burns (requires separate risk assessment and approval).

Note: There is no requirement to develop a separate SIMOPS procedure for any of the MC-252 SIMOPS events. Detailed project operating procedures specifically developed in conjunction with and referring to the MC-252 SIMOPS plan are required.

Table 7: SIMOPS Preplanning General Checklist

Activity	Well Site Leader	OIM	DPO
Vessel within 500-m of Discoverer Enterprise and DD III.	To be informed and approve arrival.	Approve.	Prepare DEN and DD III most favorable heading. Ensure communications to vessel are as planned.
In close proximity to, alongside or equipment hooked up to DEN/DD III.	To be informed.	Approve through Permit to Work (PTW) process.	Ensure communications to vessel are as planned.
Station-keeping alongside.	To be informed of met-ocean conditions and any heading change of DEN/DD III and vessel in SIMOPS.	To be informed of met-ocean conditions and any heading change of DEN/DD III and vessel in SIMOPS.	Communicate with vessel in SIMOPS on all DP matters.
Fan Beam prism installation.	To be informed of station-keeping readiness.	To determine correct height based on vessel alongside.	Ensure fully operational.
Degradation in station-keeping ability of vessel(s).	To decide on further action together with OIM.	~~Vessel Captain together with DEN/DD III~~ DPO to assess and decide on action according to WSOC. **Note: TOI strike out. Approval contingent on DPO making decision according to WSOC.**	
SIMOPS with other ops.	To be informed.	To approve.	Requirements as above.

4.2 Emergencies during SIMOPS Events

Emergencies onboard one of the vessels involved in SIMOPS impact the ability to proceed with SIMOPS. The SIMOPS planning should specifically address emergencies during SIMOPS events, mitigations and restrictions associated with such emergencies.

Use the following guidelines to shut down or postpone the SIMOPS event, which may reduce the ability of personnel to respond effectively to an emergency:

- Sheen, plume or surface debris that could impact the SIMOPS event.
- Any condition the OIM, Captain or the BP Well Site Leader determines to exist or develop and which would compromise safety of crews, equipment or vessels during the SIMOPS execution.
- Any event where acoustics communications are interfering with station-keeping of any vessel.
- Any fire requires vessels to suspend activities except those required to handle the event.
- Any hull emergency requires vessels to suspend activities except those that are required to handle the event.
- Any loss of firewater pumps requires vessel to suspend all activities at a secure point.
- Any loss of communication requires vessels to suspend all activities at a secure point.
- Any met-ocean event that could jeopardize station-keeping or operations during the SIMOPS event.
- Any event that takes a vessel out of readiness condition such as power, cooling and fuel systems, power management system, position reference systems and DP system.

4.3 SIMOPS Approval

The complexity of the SIMOPS activity determines the level of approval required for the work plan. Use the following procedure as a guideline:

- The SIMOPS Director has the overall responsibility for determining SIMOPS priorities and give necessary approvals following review with Branch Directors and Air Command.
- The SIMOPS Branch Directors approve SIMOPS events within their fleet after review with the SIMOPS Director and the respective vessels.
- The vessel OIM / Captain approves SIMOPS events associated with the respective vessel.
- The BP Well Site Leader, with input from the respective OIMs and Branch Directors determine the level of authority required to approve a safe work plan for a more complex activity inside the Discoverer Enterprise and the DD III 500-m zones.

5 Dropped Objects Prevention

5.1 Drilling Vessels

Any dropped object is to be reported through regular channels. There are no infrastructure concerns at the respective well sites. There are a number of pipelines and wellheads in the area, so dropped object prevention must have the same focus as when working in any of BP's fields.

5.2 Source Vessels and Marine Clean-up Vessels

Any dropped object must be reported as per the Incident Notification Chart. The Discoverer Enterprise and the DD III Bridges should be notified as well on any dropped object incident.

Caution:	**Vessels inside the MC-252 Incident field MUST promptly report a dropped object incident to the DEN and the DD III Bridge.**

6 Area Vessel Control and Aviation

The key to vessel control is through good communications. The daily SIMOPS call is the main venue to inform of upcoming vessel activities and requirements.

6.1 Surface Conditions

Marine debris and hydrocarbons will to a large extent determine activities at MC-252 Incident. An assessment is being made on DEN and DD III operability while being exposed to a surface sheen or the plume. Daily updates on sheen and plume developments together with marine debris updates are provided to ensure appropriate marine decisions can be made.

6.1.1 Sheen and Plume

It is likely that the DEN and the DD III will be exposed to a sheen or the plume. This depends on met-ocean conditions and the volume of hydrocarbon (HC) being released. The DEN and the DD III bridges will stay in communications with the Spill clean-up vessels and be notified of any changes in weather patterns that may result in HC reaching the well sites.

6.1.2 Marine Debris

Discovery of marine debris will be broadcasted to the fleet by the first observer. Recovery will be handled by the appropriate team as required.

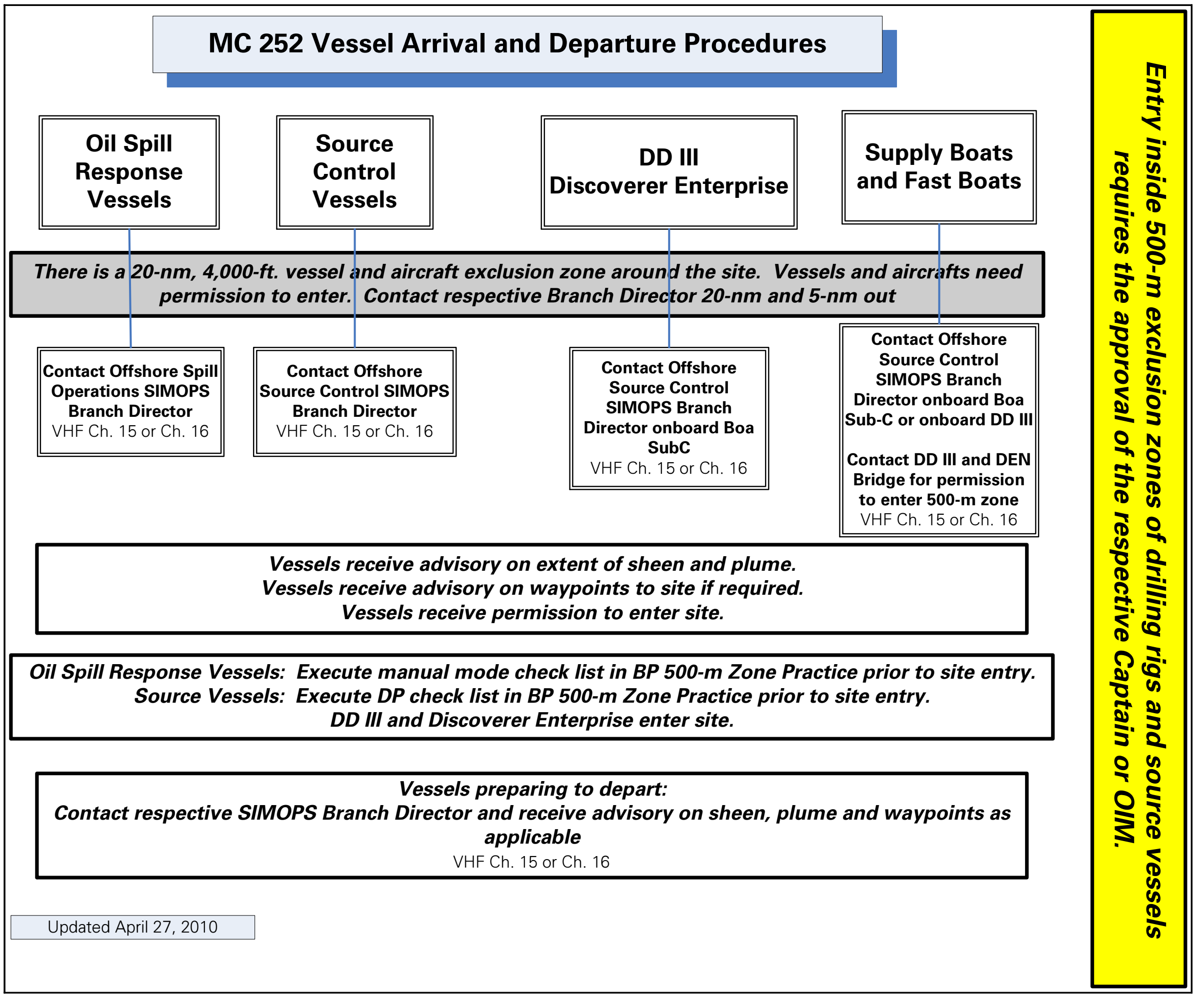
6.2 Vessel Arrival at MC-252 Incident

Surface and marine debris conditions determine how vessels arrive at the MC-252 Incident site. A Marine Debris Exclusion Zone map in Figure 7, page 33.

6.2.1 Arrival and Departure Procedures at MC-252 Incident

Vessel arrival and departure will follow the procedures set up in Figure 4, page 27. The number of vessels on DP and connected to the seabed either trough drilling risers or ROVs requires careful planning of vessel movements.

Figure 4: Vessel Arrival and Departure Procedures



6.3 Drilling Vessels

The DD III and the DEN are arriving from the SW and will move on to location from the standby and staging area once receiving approval through the Team Leader.

6.3.1 Staging Area

The DD III and the Discoverer Enterprise will move to the Staging and Standby area in MC 339 as shown in Figure 5, page 30. Preparations to start operations may be carried out at this location until approval is received for moving to the well location or the standby area to the south of the well location (see next section).

6.3.2 Standby Area

The DD III and the Discoverer Enterprise will move to the Standby area from the Staging area where operations will commence. The Standby areas are located 3,000-ft. to the south of the relief well locations RxC and RxD as seen in Figure 7**,** page 33. Conductor and tubulars may be deployed at this point.

The Standby areas are approximately half distance between the well centers and the ENI pipeline to the south (see **Figure 7**, page 34).

6.4 Source Control Vessels

Source vessels will be directed through the Incident management Command and are not expected to interact with the Discoverer Enterprise and the DD III to any extent.

The Discoverer Enterprise and the DD III 500-m exclusion zones will be adhered to. Entry into any of these zones requires Discoverer Enterprise or DD III OIM approval.

Please note that the Discoverer Enterprise and the DD III 500-m exclusion zones overlap. Any passage between the two rigs will, therefore, require Discoverer Enterprise and DD III OIM approval.

6.5 Oil Spill Response Vessels

Oil spill response vessels will be directed through the Incident Management Command via the SIMOPS Branch Director and are not expected to interact with the Discoverer Enterprise and the DD III unless the plume direction changes to the south.

It is essential that the Discoverer Enterprise and the DD III are notified of any clean-up vessel activity in the vicinity of the well operations and especially inside the rigs 500-m exclusion zones.

Note: The Discoverer Enterprise and the DD III 500-m exclusion zones will be adhered to. Entry into any of these zones requires Discoverer Enterprise or DD III OIM approval. Please note that the DEN and the DD III 500-m exclusion zones overlap. Any passage between the two rigs will, therefore, require Discoverer Enterprise and DD III OIM approval.

6.6 Hailing Channels VHF 15 and VHF 16

All vessels approaching the Discoverer Enterprise and the DD III will use VHF channels 15 and channel 16 to call up the Discoverer Enterprise or the DD III Bridge.

6.7 Working Channels

Once the targeted rig or vessel is hailed, the channel is switched to an agreed frequency as per Section 2.7, page 16.

6.8 GoM 500-Meter Zone Practice

Any vessel entering the 500-m exclusion zone of any MC-252 Incident vessel shall comply with the requirements in the 500-m Zone Practice. The document is issued by the BP Marine Vessel Operations group.

The nature of the MC-252 Incident operation, however, requires flexibility in how vessels interact. It is anticipated that the Captains on the Source Control vessels and the Spill clean-up vessels review proximity requirements between vessels and have an agreement in place concerning procedures and safeties.

Entry into the DEN and the DD III 500-m exclusion zones, however, takes place according to the 500-m Zone Practice.

Caution:	**Critical vessel repairs and maintenance shall be performed either before or after the SIMOPS event. No critical vessel repairs will be performed during the SIMOPS event or inside the DD III or the Discoverer Enterprise 500-m zone (see details in the 500-m Zone Practice). A critical repair is defined as repair that could lead to single point failure and loss of station or vessel integrity.**

6.9 Aviation

The air command in Houma is an integrated part of the SIMOPS plan. The following types of air activities are expected:

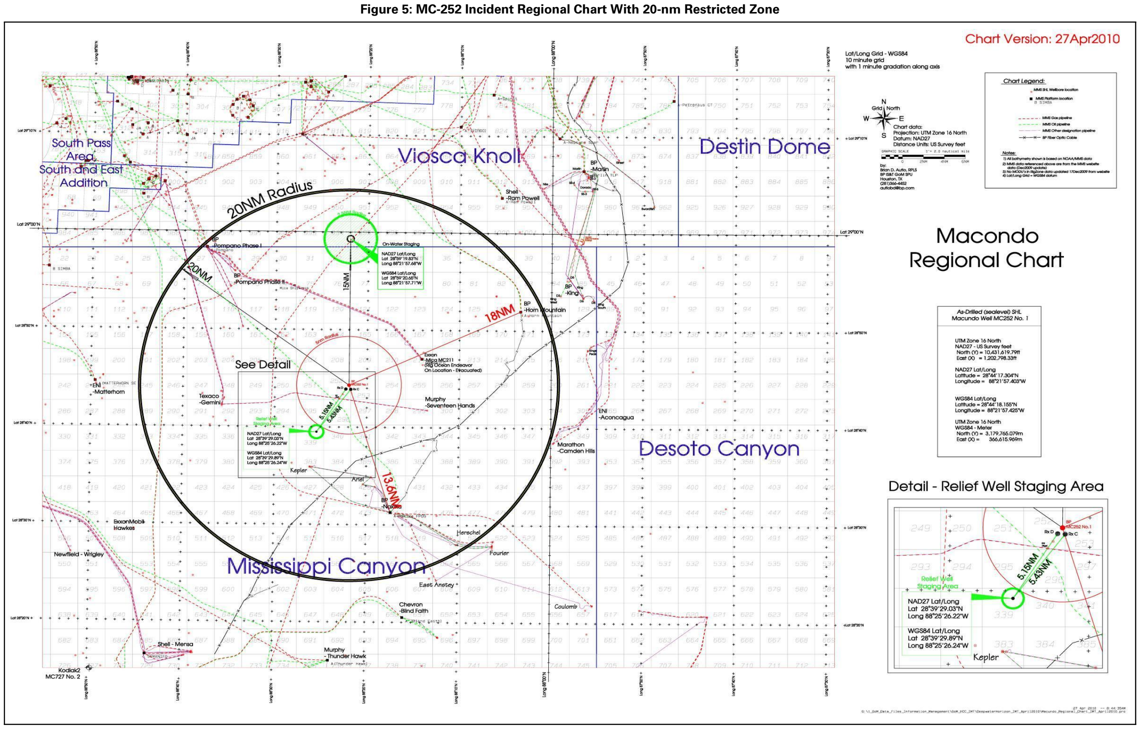
1. Helicopter crew flights to drilling rigs and source control vessels.
2. Spotter planes and fixed wing surveillance
3. Areal spray of dispersants (four aircrafts in one dispersant sortie, four to five sorties per day).
4. Over-flights of fixed wing and helicopters.
5. Drone surveillance.
6. Press and media.

The MC252 area has a restricted airspace (TFR – Temporary flight restriction) of 20-nm from site up to a 4,000-ft. elevation. Flights inside this zone are controlled by the USCG cutter Harriet Lane on site. The air command in Houma plans all flights to the site and reports through the SIMOPS Director as shown in Figure 1, page 8.

6.10 Helicopter Fueling

Helicopter fueling operations will mainly take place onshore. The aviation group will arrange emergency fueling onboard offshore facilities if needed. It is emphasized, however, that using the Discoverer Enterprise and the DD III as fueling stations for non rig flights reduces the efficiency of the drilling operations because of shut-down of cranes and deck activities.

Figure 5: MC-252 Incident Regional Chart With 20-nm Restricted Zone



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Security Classification:	Project Confidential	**Page:**	Page 30 of 55
Warning: Check DW Docs revision to ensure you are using the correct revision.			

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Figure 6: MC-252 Incident Marine Debris Map

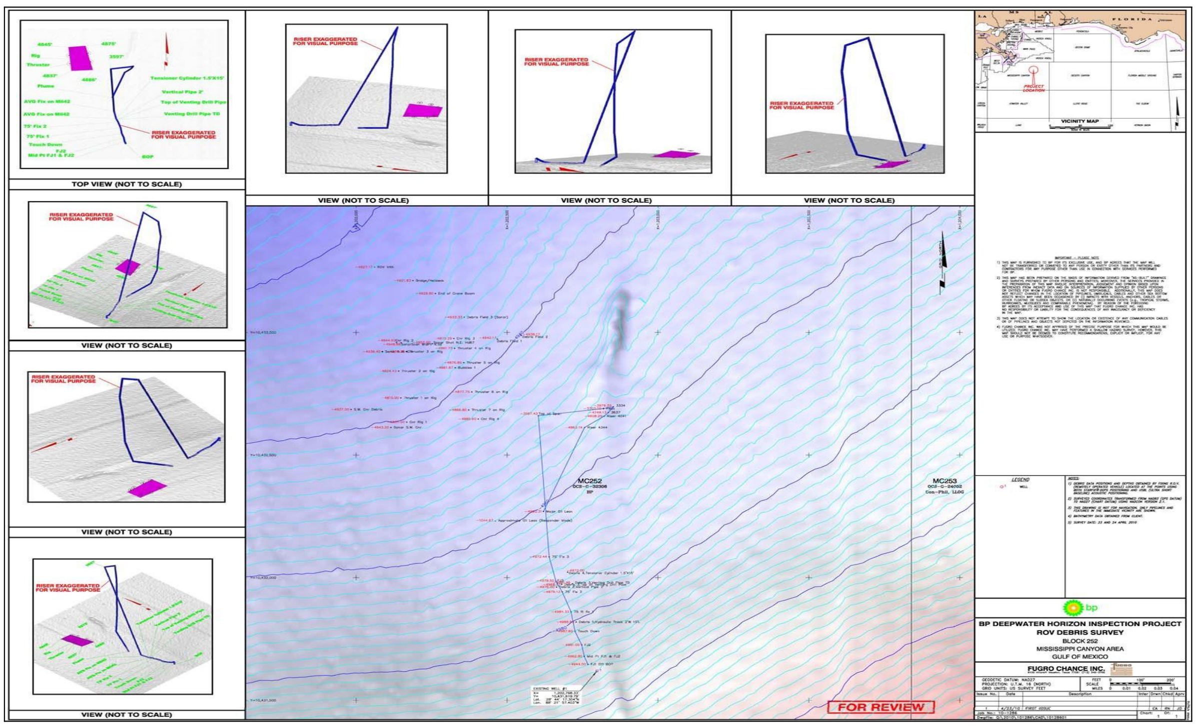

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Figure 7: Marine Debris and Discoverer Enterprise/DD III 500-m Exclusion Zones

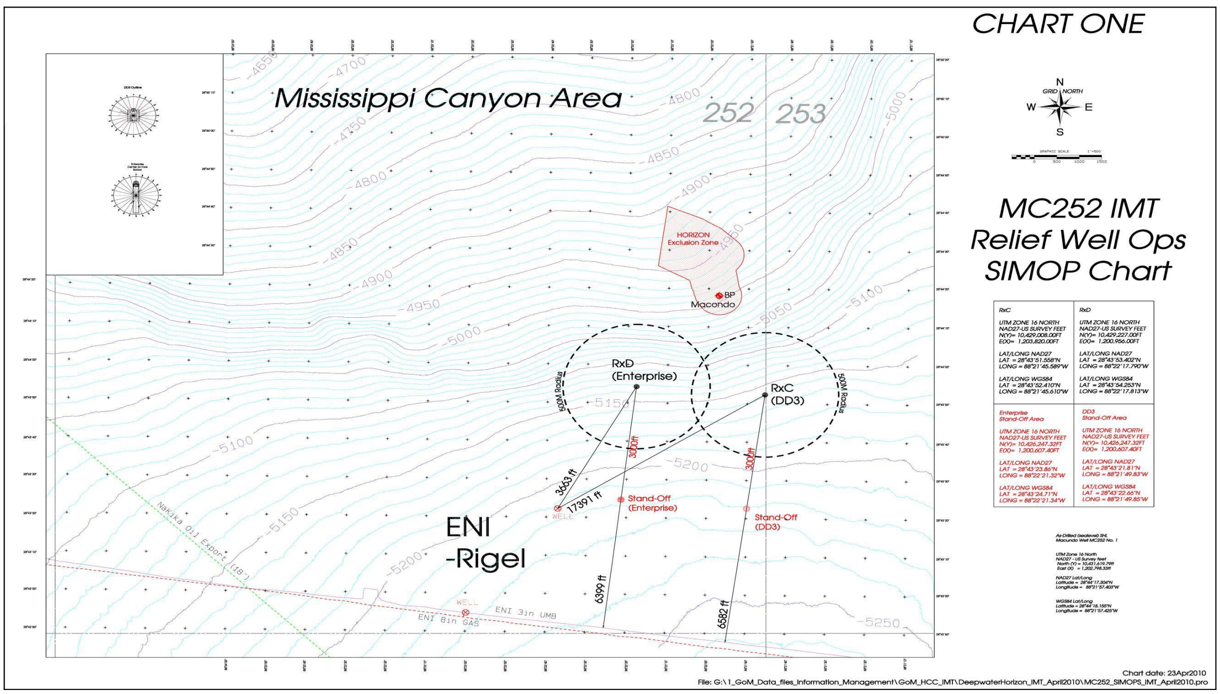

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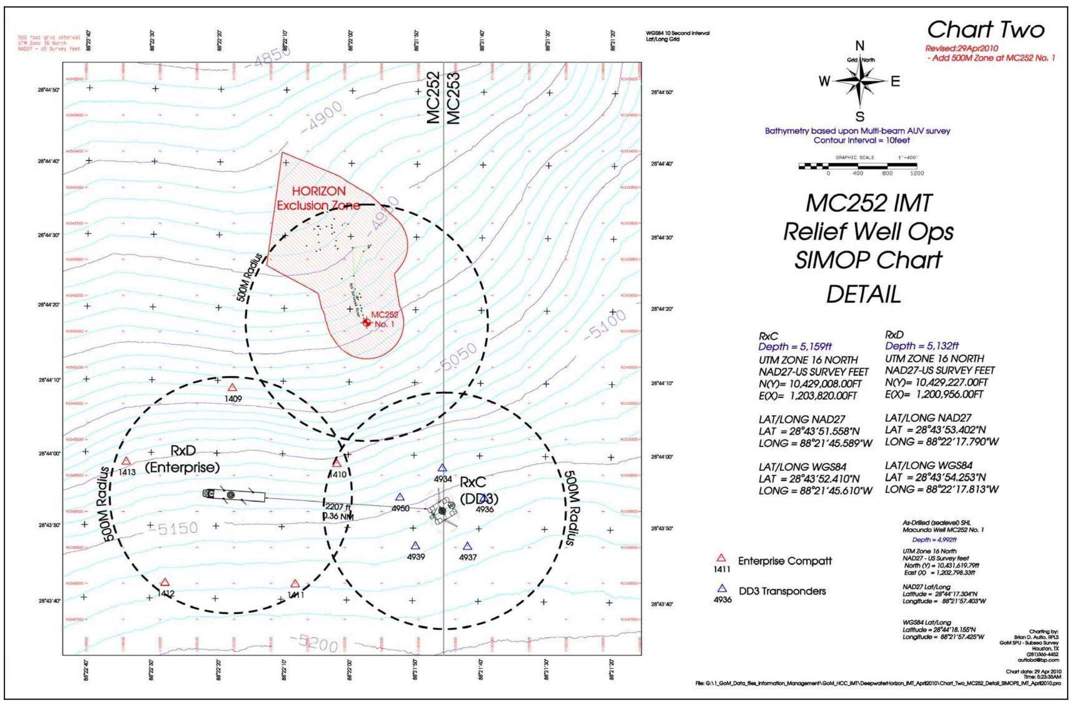
Figure 8: 500-m Vessel Exclusion Zone Detailed Map



Note: The Offshore Vessel Source Control SIMOPS Coordinator controls the debris field and an area within appr. 1,000-m of the MC 252 no. 1 well site.

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Figure 9: Discoverer Enterprise and DD III Transponder Grids

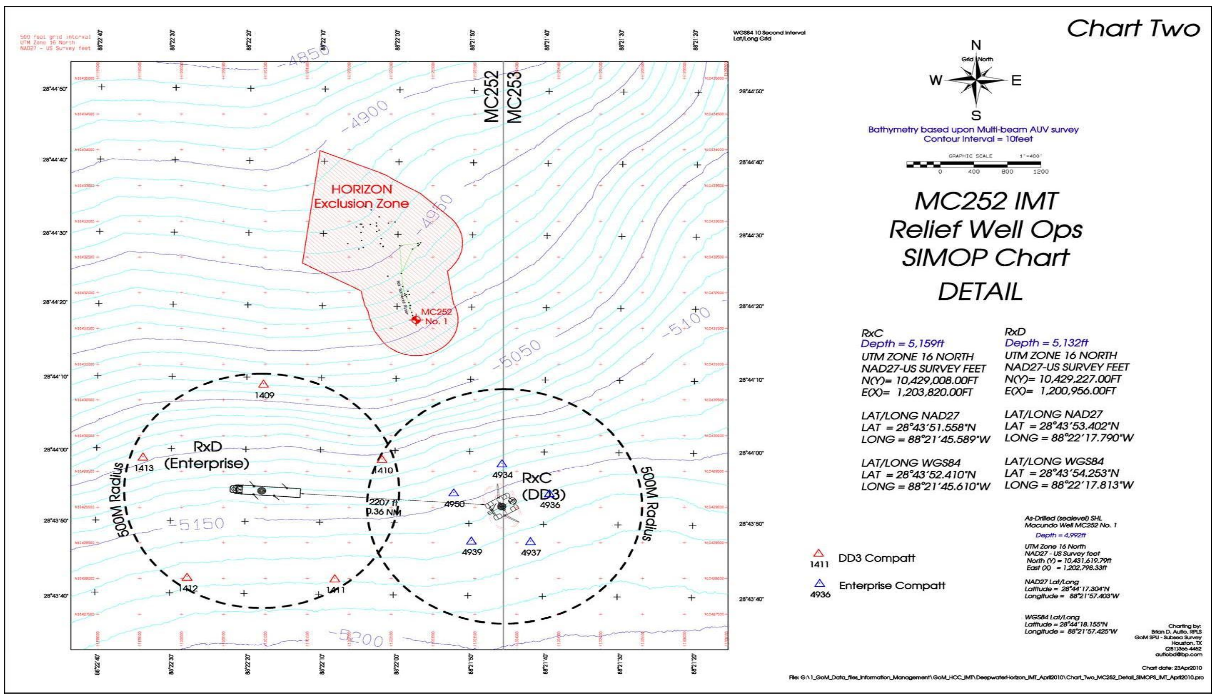

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Figure 10: Field Frequency Management Plan HiPAP vs. Sonardyne Digital

1. Discoverer Enterprise DP Array is now operating with Sonardyne MK5 Wideband COMPATTs. The array is setup for Family 14 ; C00.
LBL arrays installed at Thunder Horse must avoid allocating this family to remain clash free with the Discoverer Enterprise.

KONGSBERG HiPAP						SONARDYNE TONE CHANNELS																		
						CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CIF	CCF	CRF	CH0	CH9	DCF	CH10	CH11	CH12	CH13	CH14
VESSEL ALLOCATION	CH #	OPERATING CONDITIONS / PARAMETERS	TX1	TX2	RX	19230	19841	20491	21186	21929	22522	23148	23810	24752	25510	26042	26882	27472	28090	28735	29411	30120	30864	31645
DO NOT USE	b12	DO NOT USE	21000	21500	29250				X												X			
DO NOT USE	b13	DO NOT USE	21000	22000	29750				X	X														
DD III (VESSEL 3)	b14	Tracking	21000	22500	30250				X		X											X		
DO NOT USE	b15	DO NOT USE	21000	23000	30750				X			X											X	
OI 3 (VESSEL 4)	b16	TRACKING	21000	23500	27250				X									X						
DO NOT USE	b17	DO NOT USE	21000	24000	27750				X				X					X						
BOA SUB C (VESSEL 1)	b18	SPARE	21000	24500	28250				X					X					X					
SKANDI NEPTUNE (VESSEL 5)	b21	TRACKING	21500	21000	28500				X											X				
OI 3 (VESSEL 4)	b23	TRACKING	21500	22000	29500					X											X			
BOA SUB C (VESSEL 1)	b24	CRANE 1	21500	22500	30000						X											X		
SKANDI NEPTUNE (VESSEL 5)	b25	TRACKING	21500	23000	30500							X												
BOA SUB C (VESSEL 1)	b26	DP 1	21500	23500	27000												X							
MISS GINGER (VESSEL 2)	b27	EMERGENCY AUV	21500	24000	27500								X					X						
DD III (VESSEL 3)	b28	Tracking	21500	24500	28000									X					X					
DD III DP	b31	DP	22000	21000	28750				X	X										X				
DD III DP	b32	DP	22000	21500	29250					X											X			
DD III (VESSEL 3)	b34	Tracking	22000	22500	30250					X	X											X		
DD III DP	b35	DP	22000	23000	30750					X		X											X	
OI 3 (VESSEL 4)	b36	TRACKING	22000	23500	27250					X								X						
DD III DP	b37	DP	22000	24000	27750					X			X					X						
BOA SUB C (VESSEL 1)	b38	MILL 36	22000	24500	28250					X				X					X					
SKANDI NEPTUNE (VESSEL 5)	b41	TRACKING	22500	21000	28500				X		X									X				
MISS GINGER (VESSEL 2)	b42	AUV	22500	21500	29000						X									X				
OI 3 (VESSEL 4)	b43	TRACKING	22500	22000	29500					X	X										X			
SKANDI NEPTUNE (VESSEL 5)	b45	TRACKING	22500	23000	30500						X	X												
BOA SUB C (VESSEL 1)	b46	SPARE	22500	23500	27000						X						X							
MISS GINGER (VESSEL 2)	b47	SPARE	22500	24000	27500						X		X					X						
DD III (VESSEL 3)	b48	Tracking	22500	24500	28000						X			X					X					
DO NOT USE	b51	DO NOT USE	23000	21000	28750				X			X								X				
DO NOT USE	b52	DO NOT USE	23000	21500	29250							X									X			
DO NOT USE	b53	DO NOT USE	23000	22000	29750					X		X												
DD III (VESSEL 3)	b54	Tracking	23000	22500	30250						X	X										X		
OI 3 (VESSEL 4)	b56	TRACKING	23000	23500	27250							X						X						
DO NOT USE	b57	DO NOT USE	23000	24000	27750							X	X					X						
BOA SUB C (VESSEL 1)	b58	MILL 36 SPARE	23000	24500	28250							X		X					X					
SKANDI NEPTUNE (VESSEL 5)	b61	TRACKING	23500	21000	28500				X											X				
MISS GINGER (VESSEL 2)	b62	SEABIRD	23500	21500	29000															X				
OI 3 (VESSEL 4)	b63	TRACKING	23500	22000	29500					X											X			
BOA SUB C (VESSEL 1)	b64	CRANE 2	23500	22500	30000						X											X		
SKANDI NEPTUNE (VESSEL 5)	b65	TRACKING	23500	23000	30500							X												
MISS GINGER (VESSEL 2)	b67	SPARE	23500	24000	27500								X					X						
DD III (VESSEL 3)	b68	Tracking	23500	24500	28000									X					X					
DO NOT USE	b71	DO NOT USE	24000	21000	28750				X				X							X				
DO NOT USE	b72	DO NOT USE	24000	21500	29250								X								X			
DD III DP	b73	DP	24000	22000	29750					X			X											
DD III (VESSEL 3)	b74	Tracking	24000	22500	30250						X		X									X		
DO NOT USE	b75	DO NOT USE	24000	23000	30750							X	X										X	
DD III DP	b76	DP LIC	24000	23500	27250								X					X						
BOA SUB C (VESSEL 1)	b78	MILL 37	24000	24500	28250								X	X					X					
SKANDI NEPTUNE (VESSEL 5)	b81	TRACKING	24500	21000	28500				X					X						X				
MISS GINGER (VESSEL 2)	b82	SPARE	24500	21500	29000									X						X				
OI 3 (VESSEL 4)	b83	TRACKING	24500	22000	29500					X				X							X			
BOA SUB C (VESSEL 1)	b84	MILL 37 SPARE	24500	22500	30000						X			X								X		
SKANDI NEPTUNE (VESSEL 5)	b85	TRACKING	24500	23000	30500							X		X										
BOA SUB C (VESSEL 1)	b86	DP 2	24500	23500	27000									X			X							
MISS GINGER (VESSEL 2)	b87	SPARE	24500	24000	27500								X	X				X						

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Figure 11: HazID Rig Exposure to Oil Sheen or Plume Rig Operations

						Severity					Pre -Mitigation						Severity					Post -Mitigate							
Phase	Hazard	Hazard Scenario	Causes	Consequences	Safeguards	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Actions / Mitigation Measures	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Assigned Individual	Dates	Comments
						-	-	-	-								-	-	-	-									
Operating Rig	Oil Sheen	The results of the TOI internal HAZID were reviewed and accepted by the team. Included as a separate logsheet.				-	-	-	-							*No additional mitigations recommended.*	-	-	-	-									Note; the rig vessel master will have a conversation with the source vessels in field on their experience working the area with an oil sheen.
						-	-	-	-								-	-	-	-									Note: Vessels need a plan to flush ballast tanks prior to incident demobilization to remove any oily water in ballast tanks.
	Plume	Plume of concentrated oil comes up right under the rig.	Flow increases to a catastrophic rate. A potential cause, among others, could be failure of BOP stack.	environmental, financial.	Subsea visual, real time, monitoring of the well site area (three vessels with multiple ROV's). Existing TOI emergency procedures.	D	-	E	-	3	D3		E3			Develop a decision matrix for various scenarios of increased oil flow that could impact the drill rig.	E	-	E	-	3	E3		E3			George Gray		No
																Include in IAP that source control immediately communicates any flow changes to the SIMOPS Director											Troy Endicott		
																Develop a model to predict plume location based on subsea currents. Consider the impact of rapidly increasing flow rate.											Troy Endicott		Note: The rig response is partially based on having knowledge of expected plume location.
	Emulsion / Mousse					-	-	-	-							Determine the location and density of oil/water emulsion / mousse floating below the surface.	-	-	-	-							Troy Endicott		Note: The rig response is partially based on having knowledge of expected location of any emulsion/mousse.
						-	-	-	-							Convey IMT air monitoring and safety plan to the vessels.	-	-	-	-							Joe Neumeyer		
						-	-	-	-								-	-	-	-									

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Figure 12: HazID Rig Exposure to Oil Sheen or Plume Other Issues

						Severity				Pre -Mitigation							Severity				Post -Mitigate								
Phase	Hazard	Hazard Scenario	Causes	Consequences	Safeguards	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Actions/Mitigation Measures	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Assigned Individual	Dates	Comments
						-	-	-	-								-	-	-	-									
Moving to relief well sites	No unique hazards identified.				SIMOPS Plan is guidance document for green light to move in.	-	-	-	-								-	-	-	-									
					AUV survey to confirm no interferences at the relief well sites.	-	-	-	-								-	-	-	-									
Met ocean					Seasonably favorable winds and currents should keep slick away from rigs.	-	-	-	-								-	-	-	-									
					Historically loop currents move away from relief well drill locations. Loop currents are monitored daily.	-	-	-	-								-	-	-	-									
		Hurricane			Existing hurricane plans.																								
						-	-	-	-								-	-	-	-							Troy Endicott		
Source Control vessels		Lose ROV and view of source			Three vessels with ROV's are onsite.	-	-	-	-								-	-	-	-									
						-	-	-	-								-	-	-	-									
		Acoustic conflict			SIMOPS plan defines resolution process.	-	-	-	-								-	-	-	-									
Vessels in 500 meter zone		Spill response vessels moving into the rig 500 meter zone			SIMOPS plan includes 500 meter zone requirement.	-	-	-	-							Send 500 meter zone to branch directors.	-	-	-	-							Troy Endicott		Note: The spill response vessels may be less familiar with the 500 meter zone practice. It is also in the SIMOPS Plan.
	Dead vessel	Vessel in the area has blackout	equipment failure	Potential vessel collision	SIMOPS plan includes 500 meter zone requirement.	-	-	-	-								-	-	-	-									
	NGO's, media				Vessel security plans, JIC (joint information center) to support communications.																								
		Oil washes on deck of supply boat going to the rig.			Supply boats avoid transit through oil slick if possible. They are offloaded on the lee side of the rig and have existing cleaning procedures. Note: the supply vessels have decon procedures for leaving the area.	-	-	-	-								-	-	-	-									
Dispersant Application					Rigs would have little if any exposure. Airspace is managed outside the rigs.											Communicate to the IMT the drill rigs request to maintain a minimum of one mile distance for dispersant application or in situ burning.											Troy Endicott		
In situ burn					Burning is not planned to be done close to the rigs.																								

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Figure 13: HazID Log Rig Exposure to Oil Sheen or Plume

HAZID Log

Node 1 : DDIII & DEN operating on Macondo (MC 252)

Operation	Hazard	Preventive Controls	Consequences	Mitigating Controls	Risk Ranking: Personnel	Risk Ranking: Loss of Containment	Risk Ranking: Property Damage	Risk Ranking: Risk	Additional Safeguards	Residual Risk: Personnel	Residual Risk: Loss of Containment	Residual Risk: Property Damage	Residual Risk: Risk	Comments
Operating rig with oil sheen present.	Oily water sucked up into thruster chiller units.	Ballast down as low as reasonably practicable. DDIII: Ballast down to Operating draft prior to moving onto MC 252. Take samples through strainers during rounds.	DEN: Overheating and going into power reduction mode. DDIII: Minimal exposure.	DEN: Continuously monitored. Can isolate 1 aft and 1 fwd while being serviced depending on the weather. DDIII: Continous monitoring. 2 independent loops w/ 3 heat exchangers each. Can put ones needing to be serviced on standby. Can monitor pressure & temperature differential via VMS. Can acid wash offline heat exchanger.			Ent B4 DD III B4							
	Oily water in heat exchangers (thruster motor, main engines, rig air compressor, thruster steering, thruster lube oil, AC units)	Ballast down as low as reasonably practicable. DDIII: Ballast down to Operating draft prior to moving onto MC 252. Take samples through strainers during rounds.	DEN: Overheating and potential engine shutdown. DDIII: Minimal exposure.	DEN: Continuously monitored. Has 2 SW cooled Heat Exchangers for Main Engines. 1 as spare, and 1 as backup. DDIII: Continous monitoring. 2 independent loops w/ 3 heat exchangers each. Can put ones needing to be serviced on standby. Can monitor pressure & temperature differential via VMS. Can acid wash offline heat exchanger.			Ent B4 DD III B4							
	Oily water in drawworks cooling unit.	Ballast down as low as reasonably practicable. DDIII: Ballast down to Operating draft prior to moving onto MC 252. Take samples through strainers during rounds.	Drawworks cooler unit overheating.	DDIII: 3 individual heat exchangers for Drill Floor equipment. Can take 1 offline to clean. DEN: Has 2 for DWX cooling. Can monitor and service while 1 offline.			Ent B4 DD III B4							

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7 References

7.1.1 BP

- MC-252 Incident Offshore Coordination SIMOPS Guidelines

7.1.2 Transocean (TOI)

- See TOI DEN and DD III HSE Plans
- TOI WSOC for DEN and DD III
- TOI Operations Manual
- TOI Floating Operations Manual HQS-OPS-004, Section 4, Subsection 11: DP Operations Guidelines – Close Proximity Operations.
- DEN DP Capability Plots
- Development Driller III DP Capability Plots

7.2 Other References

7.2.1 BP

- GoM MC-252 Incident Management of Change Plan
- BP GoM TOI HSE Management System Bridging Document
- Emergency Response Plan (ERP) Document Number: 1440-85-OP-PR-0005
- GoM Safe Practices Manual (SPM) – GoM Incident Notification, Reporting and Investigation Procedure. Document Number: CD # UPS-US-SW-GOM-HSE-DOC-00115-2
- GoM IMS Vol II – Regional Oil Spill Plan
- GoM IMS Vol III – Severe Weather Contingency Plan
- GoM Contract Aircraft Guidelines
- GoM Diving Procedures
- GoM Operational Guidelines for Offshore Support Vessels
- GoM DEN Operations Manual
- 500-m Zone Practice – BP Marine
- VOI – Vessel Operating Instructions – BP Marine
- Fan Beam User Manual v. 4.1
- DMAC (Diving Medical Advisory Council) dated 1979

Appendix A: Contact Details – MC-252 Incident

Name	Telephone	E-Mail	Title
Emergencies and Regulatory			
Terrebonne General Medical Center 8166 Main Str. Houma	(985) 873-4141 Oper. (985) 873-4150 Emerg.		
US Coast Guard	(504) 589-6225 (985) 380-5320		
Houston Crisis Center BP ICP – 24 Hour Number	**(281) 366-0286 O (713) 208-6173 C (800) 321-8642 (630) 961-6200**		
MMS Houma District MMS Pipeline Section	(985) 853-5884 O (985) 879-2738 F (985) 688-6050 C (504) 736-2814 O (504) 736-2408 F (504) 452-3562 C		
Douglas, Scherie	(281) 366-6843 O (713) 702-7673 C	Scherie.douglas@bp.com	Sr. Regulatory & Advocacy Advisor
SIMOPS Director			
Endicott, troy	(281) 366-7687 O (713) 409-0061 C	Troy.endicott@bp.com	Deputy Marine Authority
Oil Spill Response Command			
Smith, Stephen (O'Brian Group)	(866) 215-4586 (866) 292-1326	mops.lar.master@msrc.org smiths3663@hotmail.com	Oil Spill Response On-Scene SIMOPS Coordinator (onboard Louisiana Responder 866-292-1326)
Source Control Vessel Command			
Sepulvado, Murry	(318) 471-1763	sepulvmr@bp.com	Source Control
TOI Discoverer Enterprise			
Captain OIM Bridge / DPO Radio room BP WSL BP Clerk / dispatch BP Subsea	(832)-587-5530/5 (713) 587-5531 713-232-8245 ext. 2008 or 2007 (713) 232-8245 (281) 366-4504 or (281) 366-4506 (281) 366-4515 (281) 366-4536	captain.den@deepwater.com Oim.den@deepwater.com dpoperator.den@deepwater.com Sat Telephone Bridge (voice): 0-11-870-353-830-551 Sat Telephone Radio Room (voice): 0-11-870-353-830-550 Iridium Sat Phone: 1-480-768-2500 code 8815-4147-9794 Radio Frequency Ch 12 VHF (MHz) - 156.650	

Name	Telephone	E-Mail	Title
Port and Stb. ROV	(713) 232-8245 ext. 2229	Radio Frequency Ch 16 VHF (MHz) - 156.800 Helicopter VHF (MHz) – 123.050 Call Sign V7HD3	
TOI Development Driller III			
DD III Well Site Leader Radio Rm. DD III Inmar Sat DPO Captain BP Dispatcher	**713-336-8218** 832-587-6871 Dial 0 for operator 011 870 764449920 x-203 and x-204 x-206 713-336-8215 713-336-8229 713-336-8201	dd3wellsiteleader@bp.com dpoperator.dd3@deepwater.com mil80@oceaneering.com Mil14@oceaneering.com	
BP Discoverer Enterprise and DD III Houston Leadership			
Gray, George	(281) 366-0659 O (713) 376-1099 C	George.gray@bp.com	DD III Team Leader
Halvorson Dory, Kathleen	(281) 366-2626 O (713) 206-5339 C	Kathleen.dory@bp.com	Drilling Engineer DEN
Jacobsen Plutt, Louise	(281) 366-5932 O (281) 685-2017 C	Louise.jacobsenplutt@bp.com	Drilling Engineer DD III
Stoltz, Dan	(281) 366-3424 O (713) 805-9972 C	Dan.stoltz@bp.com	DEN Team Leader
TOI Rig Support			
Brekke, Jim	(281) 925-6676 O (281) 961-1368 C	jim.brekke@deepwater.com	Manager Marine Technology
Blue, Mike	(832) 587-8863 O (713) 409-8217 C	Mike.blue@deepwater.com	Rig Manager Performance DD II
Hess, Adam	(832)-587-8851 O (713)-204-1837 C	adam.hess@deepwater.com	Rig Manager Performance DD III
King, Paul	(832) 587-8573 O (713) 540-6332 C		Rig Manager, Performance Discoverer Enterprise
Richards, Ramsey	(281) 925-6433 O (713) 205-9474 M (713) 782-4703 H	ramsey.richards@TOIdrill.com	Rig Manager DD III
Sims, Chuck	(281) 925-6581 O (281) 925-6583 F (832) 922-2633 C	chuck.sims@TOIdrill.com	Manager DP and Instrumentation
Walker, Stephen	(832) 587-8770 O (281) 450-7266 C	Steven.Walker@deepwater.com	Marine and DP Superintendent NAM
Logistics Boats and Helicopters Houston			
Hollier, Jamie	(281) 366-0277 O	jaime.hollier@bp.com	GoM Shelf Marine

Name	Telephone	E-Mail	Title
	(281) 366-7946 F (281) 703-0203 C		Coordinator
John Rougeau	(281)-366-5042 O (713)-201-3081 C	John.rougeau@bp.com	Deepwater Marine Coordinator
Reeves, Harold J.	(281)-366-4323 O (713)-907-3739 C	Harold.Reeves@bp.com	Subsea Ops & Intervention Leader
Verret, Brian	(337) 735-5441 O (337) 578-2425 C	Brian.verret@bp.com	Aviation Coordinator
Russell, Virgil	(281) 366-0571 O (281) 382- 3719 C	virgil.russell@bp.com	Aviation Team Lead
Huston, John	(281) 366-5795 O (713) 962-5927 C	John.huston@bp.com	GoM Logistics and Materials Management Manager
Fourchon Base			
Base Supervisor Deepwater Dispatcher Dartez, Bradley Deepwater Receiving Shipping Shore base manager Marine Dispatcher Production	(337) 735-5708 O (337) 735-5701 O (985)-396-2927 C 337-735-5726 O (281) 705-2372 C (337) 735-5702 O (337) 735-5715 O (337)-735-5703 O 337-735-5714 O 985-396-2467 C 337-735-5712 O	supvisfb@bp.com dispchfb@bp.com Bradley.dartez@bp.com Mailing address Fourchon Base: Fourchon Base Address: BP / C-Port 1 106 9th st. Lot #1 Golden Meadow, La. 70357 PH # 337-735-5708	 Logistics Coordinator
Air Logistics	337-365-6771		
PHI (Houma)	985 868 1705	Mailing Address: PHI Heliport 3622 Thunderbird Rd Houma, LA 70363 Ph.: (337) 735-5351	
BP Marine			
Fuller, Dan	(281) 366-6313 O (713) 397-4343 C	Dan.fuller@bp.com	Marine Operations Lead
Nichols, Scott	(281) 366-4815 O (713) 826-3426 C	scott.nichols@bp.com	Marine Operations Superintendent
Polk, Daniel	(281) 366-0538 (713) 825-2657	Daniel.polk@bp.com	Marine Operations Lead

Name	Telephone	E-Mail	Title
Vessels			
Source Control Vessels			
Ocean Intervention - 3	713-744-5929 713-744-5920	captain@intervention.islandoffshore.com	
BOA Sub C	832-461-8266 Client Office 832-461-8269 owner office	captain@boasubc.no	
Boa Deep C	203-575-5434 client office 203-575-5431 owner office 203-575-5437 Bridge	offshore-supervisorbdc@boa.no	
C-Express	985-612-2301 Bridge 985-612-2304 ROV	mv.c-express@chouest.com	
Skandi Neptune	+47 5618 1180 / 1181 +44 7894 173973	captain@neptune.dof.no	
Nikola	225-289-6112	nikola@teslaoffshore.com	
Miss Ginger	Data Van: (337) 769-9032 Bridge: (337) 769-9033 IP Phone: 337-735-3695 5701 (Geophysical Lab) 5704 (Bridge) Bridge (Sat Phone): (866) 215-6199 Captain Cell in Port: (985) 677-2582	miss.ginger@cctechnol.com missginger34@yahoo.com	
Spill Cleanup Vessels			
Joe Griffin	985-612-2417	mv.joe.griffin@chouest.com	
C-Captain	254-543-7829 985-612-2346	mv.c-captain@chouest.com	
C-Commander	254-460-9996 985-612-2348	mv.c-commander@chouest.com	
C-Enforcer	254-240-1951 985-612-2341	mv.c-enforcer@chouest.com	
C-Carrier	011-881-651-436535	mv.c-carrier@chouest.com	

Name	Telephone	E-Mail	Title
	985-612-2330		
C-Fighter	985-612-2319	mv.c-fighter@chouest.com	
Dante	863-833-5817 985-612-2326	mv.dante@chouest.com	
Kobe Chouest	254-381-2760 985-612-2335	mv.kobe.chouest@chouest.com	
C-Pacer	254-381-3953 985-612-2337	mv.c-pacer@chouest.com	
C-Express	Bridge 985-612-2301 ROV 985-612-2304	mv.c-express@chouest.com	
Amy Chouest	863-833-8709 985-612-2344	mv.amy.chouest@chouest.com	
C-Courageous	985-612-2322	mv.c-courageous@chouest.com	
C-Hero	011-881-651-436647 985-612-2354	mv.c-hero@chouest.com	
C-Freedom	985-612-2306	mv.c-freedom@chouest.com	
Celena Chouest	985-612-2302	mv.celena.chouest@chouest.com	
C-Legacy	254-204-3130 985-612-2355	mv.c-legacy@chouest.com	
Fast Cajun	011-881-651-423025 985-612-2357	mv.fast.cajun@chouest.com	
Fast Sailor	985-612-2359	mv.fast.sailor@chouest.com	
Pat Tillman	985-612-2409	pattillman@tdwboats.com	
Damon Bankston	985-612-2406		
Gulf Princess	985-612-2407		
Sailfish	985-612-2408		
CapRock			
CapRock Champagne, Ken	337-593-5514	kchampaigne@caprock.com	Telephone system Edison Chouest
C&C Technologies Surveying			
C&C Technologies George L. Buhler	(713) 468-1536 O (281) 914-9629 C	George.buhler@cctechnol.com George.buhler@sbcglobal.net	Survey advisor
DOF Surveying			
DOF John Roscoe-Hudson	(713) 785-0788 o (713) 677-4838 c	jrh@geocentury.com	ADCP profiling system SROV

Name	Telephone	E-Mail	Title
Edison Chouest Offshore			
Edison Chouest Offshore Shannon Doucet,Jr. Michael Burke	(985) 601-4444 O (985) 601-4346 P (985) 677-1703 C (985) 691-7514 C (713) 395-4448 O (713) 251-6326 F (281) 798-7880 C	shannon.doucet@chouest.com michael.burke@bp.com	Sr. Operations Manager Operations Coordinator
Fugro Surveying			
Fugro Larry Prewitt Parker, Anthony 24-hour Dispatcher Ken Richter	337-237-1300 O 337-268-3130 Dir 337 962- 0108 C 337-237-1300 800-858-5322 713-346-3656 O 713-305-4409 C	lprewitt@fugrochance.com marinesup@fugrochance.com krichter@fugro.com	Manager Lafayette surface systems Supervisor Marine Operations Survey USBL
Oceaneering			
Oceaneering Tony Butler Dale Tompkins Albert Parker David Sheetz Lee Willmore Mark Van Dyke	985-395-5247 O 985-395-8501 O Dir 985-397-1732 C 985-395-8519 F 985-395-1105 wk 985-518-3274 C 985-395-5247 after hours 713-422-5953 (713) 329-4271 O (832) 444-8885 C 832-467-7734 O 713-430-6268 C (281) 366-4271 O (713) 447-6407 C	TButler@oceaneering.com DTompkins@oceaneering.com ALParker@oceaneering.com dsheetz@oceaneering.com LWillmore@Oceaneering.com mvandyke@oceaneering.com	ROV Ops. Manager DTS Ops. Mgr. ROV Sup. Marianas Sr. Supervisor Project Manager-Tooling DW Technical Solutions Team Lead OI1
Project Support			
Driver, David B.	(281) 366-2699 O (281) 366-7941 F (832) 661-2183 C	david.driver@bp.com	Met-ocean Specialist
Frazelle, Andrew	(281) 366-8792 O (713) 213-3505 C	Andrew.frazelle@bp.com	D&C Operations Manager

Name	Telephone	E-Mail	Title
Haaland, Kurt	(281) 366-5085 O (281) 366-7557 F (281) 705-3237 C	haalak@bp.com	Manager fiber optics project
Hafle, Mark	(281) 366-4237 O (281) 687-8216 C	Mark.hafle@bp.com	Senior Drilling Engineer
Hughes, John	(281) 249-7678 O (713) 480-0148 C (281) 646-9956 H	john.hughes2@bp.com	Well Systems Lead
Karlsen, Geir	(281) 366-4880 O (713) 855-7369 C (936) 273-9257 H	geir.karlsen@bp.com	MC-252 Incident SIMOPS
Mouton, Keith	(281) 366-4303 O (281) 703-9589 C	Keith.mouton@bp.com	GoM SPU HSSEr Team Leader
Munstereifel, Eric	(281) 249-1678 O (281) 467-5257 C	Eric.munstereifel@bp.com	Subsea Lead
Neumeyer, Joe	(281) 366-3082 O (281) 546-4918 C	Joe.neumeyer@bp.com	D&C HSSE Advisor
Rayburn, Dean	(281) 366-1245 O (713) 208-6169 C	dean.rayburn@bp.com	D&C HSSE Team Leader
Dave Rich	(281) 366-3676 O (281 785 3676	Dave.rich@bp.com	Wells Manager
Russell, Virgil	(281) 366-0571 O (281) 382 3719 C	Virgil.russell@bp.com	Aviation Team Lead
Sanders, Robert	(281) 366-4488 O (713) 301-6514 C	robert.sanders@bp.com	Team Leader DD III
Sims, David	(281) 366-0360 O (713) 304-5600 C	David.sims@bp.com	Wells Ops. Manager
Sprague, Jonathan	(281) 366-5871 O (281) 387-7509 C	jonathan.sprague@bp.com	Drilling Engineering Manager
Verret, Brian	(337) 735-5441 O (337) 578-2425 C	Brian.verret@bp.com	Aviation Coordinator
Pipeline Control Center			
Tulsa Control Center	(918) 660-4451	billy.sherrard@bp.com guy.proctor@bp.com kevin.arrington@bp.com raymond.jones@bp.com william.b.todd@bp.com roger.easterling@bp.com	Tulsa Control Center contacts all facilities during an emergency.
Updated April 28, 2010			

GulfofMexicoSPU

bp

MC-252 Incident
SIMOPS Plan

1	4/29/2010	Final – issued for Use	Geir Karlsen	Houston Incident Commander
0	4/28/2010	Final – Issued for Comments	Geir Karlsen	Houston Incident Commander
Rev	**Date**	**Document Status**	**Custodian/Owner**	**Authority**

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Control Number	2200	T2	DO	PN	4001	1

AMENDMENT RECORD

Revision Number	Amender Initials	Date	Amendment
A	G. Karlsen	April 24, 2010	Initial draft.
B	K. Mouton	April 25,2010	Edits
C	G. Karlsen	April 27, 2010	Comments incorporated.
0	G. Karlsen	April 28, 2010	Comments incorporated, issued for use. Clarified and added comment to Section 1.3: Clarified section and added comment "Source Control SIMOPS Director covers an area of appr. 1,000-m from site". Added Sections 6.9 on Aviation and Section 6.10 on Helicopter Refueling. Added section 1.8 (HazID of operating in contaminated waters and added HazID documents. Updated contact details and general cleanup of doc. Added doc. number from Doc. Control.
1	G. Karlsen	April 29, 2010	Removed 1000-m radius circle from map Fig. 9 and updated with debris field.

REVIEWER SIGN-OFF			
	Name	**Signature (PLEASE PRINT)**	**Date**
Custodian/Owner	Geir Karlsen		
Reviewer (s)	BP Marine Assurance Rep		
	BP Geohazards Rep (AUV,HR2D)		
	BP (IMT) Spill Operations		
	BP Wells Rep		
	BP (IMT) Safety Officer		
	BP (IMT) Source Control Operations		
	IC Houston		
	IC On-scene Houma		
	USCG Houston		
	USCG On-scene Houma		
Authorizer (s)	BP Discoverer Enterprise Lead		
	BP DD III Lead		
	BP GoM Marine Authority		
	Transocean Incident Commander		
	BP Incident Commander		
	BP On-Scene Commander		

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FIGURES

TABLES

1 Introduction

1.1 SIMOPS Plan Objectives

The goal of the MC-252 Incident Simultaneous Operations (SIMOPS) Plan is safe and efficient execution of the SIMOPS between all marine and aviation assets deployed in support of the spill and source control operations. The majority of the assets are provided or sourced by:

- Transocean Offshore Inc.
  - Development Driller III (DD III) semisubmersible
  - Discoverer Enterprise (DEN) drillship
- BP Logistics and Aviation (PHI, Chouest, Tidewater, VIH Cougar, Graham Gulf)
- Marine Spill Response Corp (MSRC)
- National Response Corp (NRC)
- Aker Marine
- Subsea 7
- Airborne Services Inc (ASI)
- USCG

The plan seeks to:

Inform members of the unified command involved in SIMOPS for the MC-252 Incident of the principles required for conducting simultaneous operations.

Identify the SIMOPS hierarchy for the major scopes of work between Spill Recovery, Well Control operations and drilling of relief wells.

Outline high-level procedural steps complimented by the detailed processes, procedures and plans (3P) issued by the respective groups. The 3P's are issued and reviewed in conjunction with Hazard Identification (HazID) assessments or planning meetings just prior to the SIMOPS event.

Concurrent operations onboard the assets described above are NOT covered or included in the SIMOPS Plan unless these activities affect other MC-252 Incident operations.

1.2 What Does Success Look Like?

Success is defined as zero SIMOPS clashes, zero SIMOPS impact to schedules and zero SIMOPS incidents. Getting to zero is only possible by strict discipline in the part of all stakeholders to adhere to the elements of the plan.

Remember: "Good SIMOPS is all in the communications."

1.3 The SIMOPS Team

SIMOPS Director - Overall responsibility for coordinating the execution of SIMOPS events. The SIMOPS Director resides in Houston.

Offshore Spill Operations SIMOPS Branch Director - Overall responsibility for coordinating the execution of Spill SIMOPS events. Position resides onboard Louisiana Responder.

Offshore Source Vessel Control SIMOPS Branch Director - Overall responsibility for coordinating the execution of Source Vessel Control SIMOPS events. Position resides offshore onboard the DD III or the Discoverer Enterprise. The Branch Director generally controls the areas inside the rigs 500-m zone and an area of appr. 1,000-m from the Macondo site. See **Figure 8**, page 33.

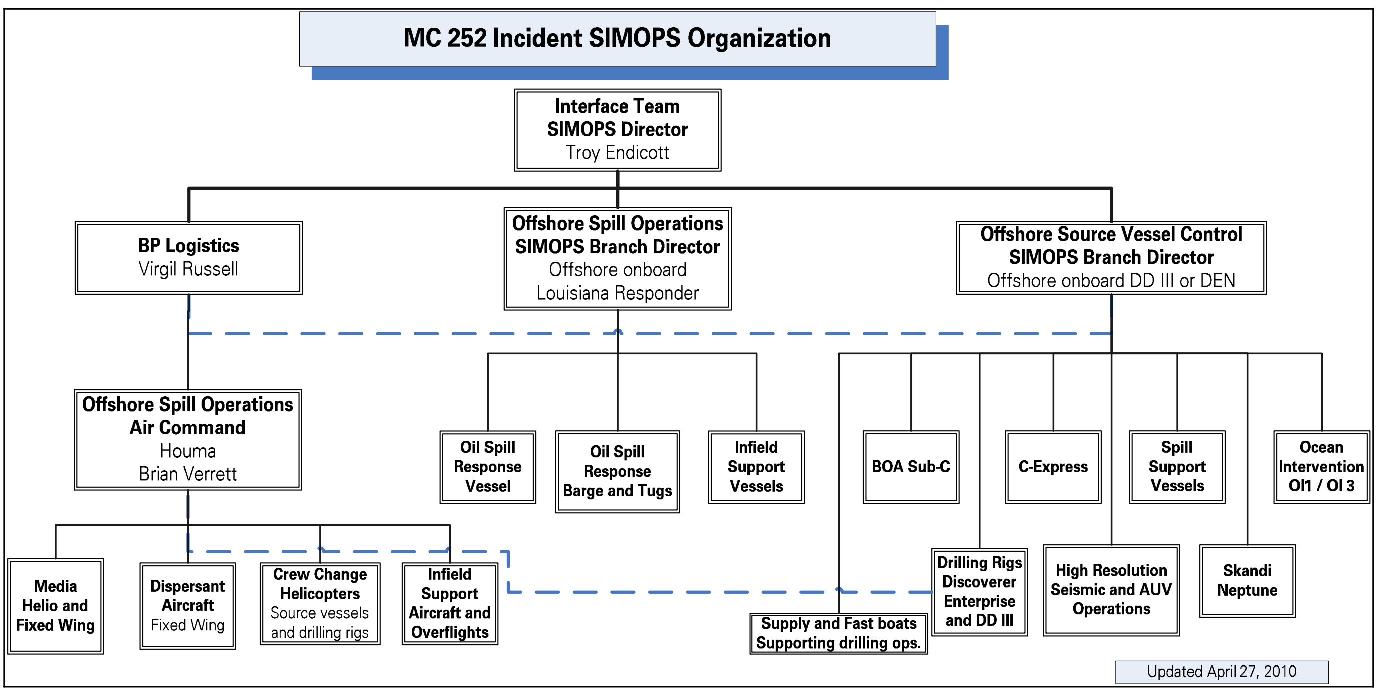
BP Logistics - Overall responsibility for providing air support to the project. Group resides in Houston.

Offshore Spill Operations Air command - Overall responsibility for coordinating and scheduling all aircrafts including fixed wing, crew change helicopters, dispersant deployments, over flights, recons and spotter planes. Position resides in Houma.

Vessel Person in Charge (VPIC) – Is the BP Vessel Rep. onboard. Can also be the OIM or the Well Site Leader. The VPIC is responsible for all Health, Safety, Security and Spill (HSSE) incidents. All incidents will be reported using the Notification scheme contained within the plan.

Note: Any person involved in a SIMOPS event has the authority and obligation to discontinue and shut down the SIMOPS event in the case of safety or operational concerns.

Figure 1: SIMOPS Communications Plan



SIMOPS events will be coordinated through daily SIMOPS call as per Section 2.5, page 14.

1.3.1 Onshore SIMOPS Director Responsibility

- Chair the daily SIMOPS call (see Section 2.5, page 14).
- Be the overall coordinator of SIMOPS activities at MC-252 Incident.
- Ensure SIMOPS events comply with HSSE guidelines.
- Identify need of SIMOPS HazIDs and SIMOPS reviews prior to a SIMOPS event.
- Assess potential schedule impact and associated risks from upcoming SIMOPS events.
- Liaison with leadership team on SIMOPS issues, scheduling and technical conflicts.
- Identify critical path and determine which operation has priority.
- Assess risks of single and multiple operations and SIMOPS events.
- Facilitate resolutions of any SIMOPS conflicts with the teams.
- Coordinate SIMOPS issues between the Discoverer Enterprise, DD III, Marine Activities and Aviation.

1.3.2 Offshore Spill Operations SIMOPS Branch Director Responsibility

- Be the overall coordinator of the execution of SIMOPS activities in the spill clean up operation.
- Direct vessels as per the daily operating plan.
- Identify resource needs.
- Liaison with the vessels in the cleanup fleet.
- Ensure spill cleanup SIMOPS events comply with HSSE guidelines.
- Assess potential schedule impact and associated risks and convey to the SIMOPS Director.
- Work with vessel Captain on all SIMOPS and HSSE.

1.3.3 Offshore Vessel Source Control SIMOPS Branch Director Responsibility

- Be the overall coordinator of the execution of SIMOPS activities in the fleet of source vessels.
- Area of responsibility is in the Macondo well area and the debris field out to appr. 1,000-m from site.
- Direct vessels as per the daily operating plan.
- Identify resource needs.
- Liaison with the source vessels.
- Ensure vessel activities comply with HSSE guidelines.
- Assess potential schedule impact and associated risks and convey to the SIMOPS Director.

1.3.4 Vessel Representative (VPIC)

Source control vessels and possibly some of the spill cleanup vessels will have a vessel rep. onboard. The vessel rep. responsibility is to:

- Implement specific programs concerning ROV, salvage, search and clean-up.
- Ensure HSSE and safety guidelines are followed onboard the vessel and in vessel ops.
- Provide guidance for the specific operation.
- Comply with operating procedures and applicable MC-252 Incident SIMOPS requirements.
- Work with vessel OIM or Captain on SIMOPS issues.
- Call-in on the daily SIMOPS call.

1.3.5 SIMOPS Interface Team (Member)

Assigned for each area of operations, such as well operations, ROV operations, spill clean-up, AUV and 2D Seismic surveying, Salvage and Recovery operations. The position resides onshore. Responsibilities are:

- Implement specific installation and construction programs.
- Arrange SIMOPS review meetings and HazIDs.
- Comply with operating procedures and applicable MC-252 Incident SIMOPS requirements.
- Establish communication plan between their SIMOPS supervisory personnel.
- Assist the MC-252 Incident SIMOPS Director in implementing the MC-252 Incident SIMOPS Plan.
- Provide progress report to the MC-252 SIMOPS Director.

1.4 Management of Change (MoC)

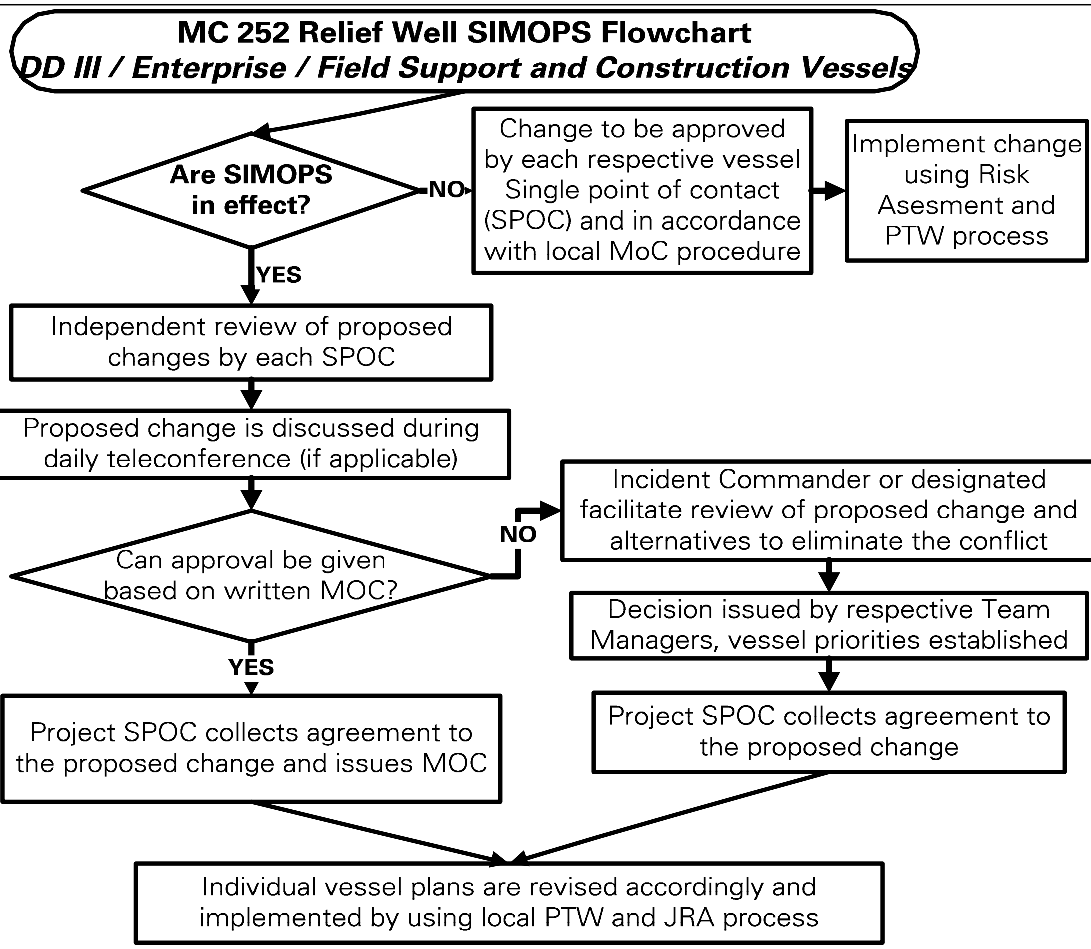
The MoC process is used in conjunction with changes to procedures and the SIMOPS schedule. Temporary and permanent changes are managed to ensure that health, safety, and spill risks remain at acceptable levels. The plan intends to exceed BP's Operations Management system (OMS), expectations, regulatory requirements and local needs.

Figure 2, page 11 shows the SIMOPS MoC procedure for changes in the MC-252 Incident program.

The GoM MoC process uses BizFlow found at the BP Intranet site:

http://gomdnc.bpweb.bp.com/bam/RP/Wiki%20Pages/Management%20of%20Change.aspx

Figure 2: MC-252 Incident SIMOPS MOC Process



Issue MoC

The approved GoM D&C Recommended Practice for Management of Change (MoC) is on the GoM D&C Sharepoint site under: Processes / Recommended Practices / Management of Change.
http://gomdnc.bpweb.bp.com/bam/RP/Wiki%20Pages/Management%20of%20Change.aspx

In this Recommended Practices Site, you will find the GoM D&C Recommended Practice for Management of Change as well as the link to the BizFlow tool, and a link to the MOC Quick Reference Guide.

Updated Apr. 27, 2010

1.5 HazID Assessing Operations in a Contaminated Environment

A HazID was held April 28, 2010 to assess the risks of the Discoverer Enterprise and the DD III being exposed to hydrocarbons either from a sheen or from a plume of oil. The HazID followed Trans Ocean's internal HazID the previous day.

There were no show stoppers identified during either HazID. The Operation Teams of the Discoverer Enterprise and the DD III were tasked with the assembly of an emergency disconnect plan should the direction of the plume change towards the rigs or should there be a catastrophic change to the volume of released hydrocarbons.

The HazID action items are found in Table 1 below.

Table 1: HazID Action Items

	Activity	Action	Responsible Person	Due Date
1	**Rig Operations**	Develop a decision matrix for various scenarios of increased oil flow that could impact the drill rig.	George Gray	
2		Include in IAP that source control immediately communicates any flow changes to the SIMOPS Director	Troy Endicott	Prior to ops.
3		Develop a model to predict plume location based on subsea currents. Consider the impact of rapidly increasing flow rate.	Troy Endicott	
4		Determine the location and density of oil/water emulsion / mousse floating below the surface.	Troy Endicott	
5		Convey IMT air monitoring and safety plan to the vessels.	Joe Neumeyer	Prior to ops.
6	**Other Operations**	Send 500 meter zone to branch directors.	Troy Endicott	Prior to ops.
7		Communicate to the IMT the drill rigs request to maintain a minimum of one mile distance for dispersant application or in situ burning.	Troy Endicott	Prior to ops.

The risk ranking and HazID results are found in Figure 11, page 36, Figure 12, page 37 and Figure 13, page 38.

2 Field Communications and Emergencies

2.1 Crisis Management

The Gulf of Mexico Deepwater Development (GoM DWD) Emergency Response Plan Guidelines are initiated should any emergency occur during a SIMOPS event. The SIMOPS event will be terminated or postponed until the emergency is cleared.

Any emergency onboard the Discoverer Enterprise, the DD III or associated vessels will be reported immediately to the other vessels and the Offshore SIMOPS Branch Director to ensure necessary precautions can be taken.

2.2 Severe Weather Contingency Plan

See GoM IMS Vol. III – Severe Weather Contingency Plan (see References in Section 7, page 39).

The Crisis Center at WL-4 handles the management of severe weather planning and field evacuation guidance.

2.3 Emergency Evacuation Plan

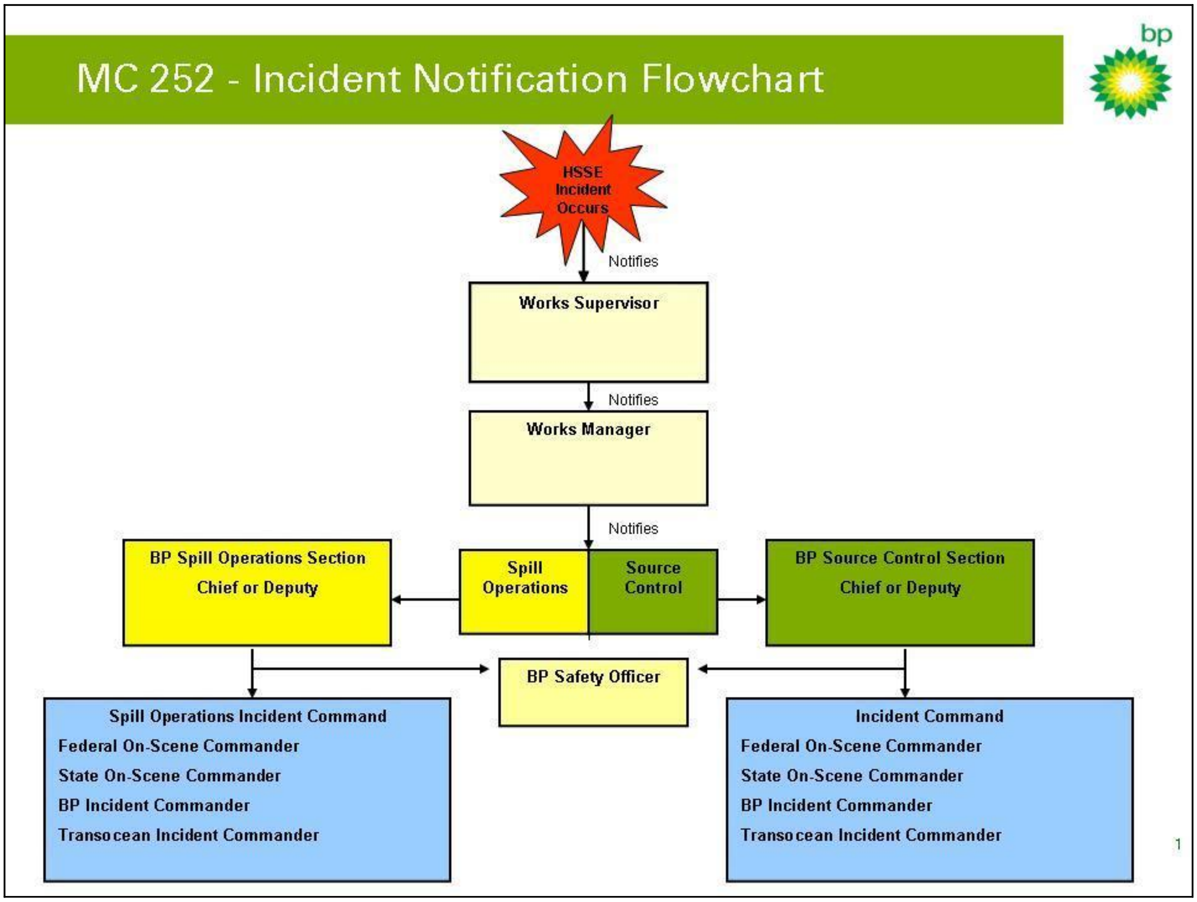
See GoM DWD Emergency Evacuation Plan (see References in Section 7, page 39).

2.4 Incident Notification

The Incident Notification Chart shown in Figure 3, page 14 is the main routing of incident notifications on the project.

It is recognized, however, that the MC-252 Incident operation is complex and that there is a possibility of incidents being reported through different channels.

Figure 3: Incident Notification Chart



2.5 Daily SIMOPS Conference Call

The SIMOPS Director chairs the daily SIMOPS conference call.

The following calls in to the SIMOPS call:

1. Each MC-252 Incident ROV and construction vessel
2. The lead spill clean-up vessel.
3. Houma IC.
4. Houston IC.
5. Discoverer Enterprise and DD III OIM and Well Site Leader (WSL) or designees.
6. BP vessel rep. and PIC on vessel(s) performing SIMOPS in the MC-252 Incident field.
7. Impact Weather and Horizon Marine (only if met-ocean conditions dictate).
8. Shore-based personnel as required

Work boats and fast boats are not required to participate.

The purpose of the daily SIMOPS conference call is to:

- Provide daily SIMOPS support to all MC-252 Incident groups.
- Get the latest met-ocean updates (Impact Weather and Horizon Marine to participate on an as-needed-basis).
- Ensure all activity centers are fully aware of ongoing and upcoming field activities and SIMOPS events.
- Review SIMOPS schedule issues.
- Ensure activities from outside operators (such as pipe-lay and seismic operations) are flagged.
- Review VHF and acoustics communication needs and clashing issues.
- Ensure the SIMOPS events are planned and executed according to the program with no impact to HSSE and minimum impact to other operations.

Table 2 below shows the details of the conference call center.

Participants call the Toll-free or the Toll numbers and then the Pass-code to get into the conference call.

Table 2: Conference Call Center

Dial-In Numbers and Pass Codes	Toll-Free number from inside USA:	1-866-634-1110
	Participant pass code:	925-727-0145

Each operation issues a daily SIMOPS report to the SIMOPS Director that is reviewed prior to the SIMOPS call. The report is a short synopsis of last 24-hours and the coming 24-hours utilizing Incident Action Plan (IAP).

The SIMOPS call agenda is:

- Met-ocean update (wind, waves and currents).
- Sheen, plume and marine debris update.
- Vessel Summary
  - Discoverer Enterprise – Current operations, SIMOPS events, next activity, special issues, Q&A.
  - DD III – Current operations, SIMOPS events, next activity, special issues, Q&A.
  - ROV vessels – Current operations, special issues, Q&A.
  - Construction and intervention vessels – Current operations, SIMOPS events, next activity, special issues, Q&A.
  - Barge and tugs – Update on current operations and next 24-hrs.
  - Spill clean-up vessels – Area of operation, sheen and plume update.
- SIMOPS issues, communications and VHF use, scheduling, conflicts and concerns.

2.6 SIMOPS Communication Guideline

Well-planned and established communications are keys to the successful execution of the MC-252 Incident SIMOPS. The SIMOPS Branch Directors must communicate with the respective Vessel Reps. / OIMs / Captains prior to the start of any SIMOPS activity and during the SIMOPS event as conditions require.

Remember: "Good SIMOPS is all in the communications."

2.7 Field Communications

2.7.1 Hailing Channels VHF 15 and VHF 16

Vessels approaching the field will use Channels 15 or channel 16 to call up the Discoverer Enterprise or the DD III Bridge. Channel selection, following the initial hailing is agreed upon with the respective installation.

Channel 15 and channel 16 are always monitored by the Discoverer Enterprise and the DD III. See Table 3, page 16.

Once the appropriate MC-252 Incident facility (Discoverer Enterprise or DD III) is hailed, the channel is switched to an agreed frequency as per Table 3. The table is a guideline and lists the agreed MC-252 Incident VHF channels. It is anticipated that radio noise and high usage may require selection of other channels at times.

The fleet of Source Control and Oil Spill Response vessels will work through the Onshore SIMOPS Director to establish field radio procedures and agree on channel selections.

Radio use and frequency selection will be part of the daily SIMOPS call.

Table 3 below shows the VHF hailing and the working channels for the MC-252 Incident field.

Table 3: VHF and UHF Working Channels

Location	Discoverer Enterprise	Discoverer Enterprise ROV	DD III	DD III ROV
Hailing general	16		16	NA
Bridge to Bridge	15		13	
Bridge to boat	10, 11, 12		13	
Port crane	10, 11, 12		67	
Starboard crane	10, 11, 12		68	
Crane to boat	10, 11, 12		Port: 67, Stb. 68	
Bulk and liq. Transfer	8, 15		72, 88	
ROV	No radio	8		72, 88
Discoverer Enterprise Bridge to maintenance	64	NA	NA	NA
Spare channels	6, 69, 71, 73		6, 69, 71, 73	
UHF	2, 5, 9		3, 6, 9, 13	3, 6, 9, 13
Helicopter	123.05		122.700	
Notes:	Source control vessels and environmental cleanup vessels are hailed on ch. 15 and ch. 16			
				Updated April 27, 2010

2.7.2 Radio

Vessels and aircraft, under contract to BP, are equipped with BP radios in addition to the contractor's communication equipment.

Operators of vessels involved in SIMOPS activities must agree upon *primary* and *secondary* radio communication frequencies prior to the start of any SIMOPS activity.

Note: Conduct radio check and confirm operability prior to start of any SIMOPS event.

2.7.3 Emergency Communications

For emergency response communication procedures and contact information, reference the "GoM DWD Emergency Response Plan" (see Section 7, page 39).

3 Acoustic Frequency Management and Position Referencing

The Acoustic Frequency Management Plan is summarized in Table 6, page 22 and in Figure 10, page 35.

Please note the following:

1. Horizon DP array transponders have been recovered and are not featured in the plan.
2. It is essential that all vessels with dual head HiPAP systems configure the system to track all transponders from a single head (all transponders tracked from the same head).

3.1 Enabling and Disabling of Transponders and Responders

The Dynamic Positioning Operator (DPO) onboard the Discoverer Enterprise and the DD III are responsible for the management and safe use of the acoustic frequencies at MC-252 Incident.

No acoustics will be turned on or off without the concurrence of the DPO onboard the Discoverer Enterprise and the DD III.

Warning:	**The Discoverer Enterprise and the DD III DPO will manage the acoustics in the MC-252 Incident field. There will be no enabling or disabling of acoustic channels without the DPO's concurrence.** **Do not change allocated channels without the concurrence of the Discoverer Enterprise and the DD III DPO. The main requirement of the Acoustic Management Plan is to prevent frequency clashing and risk interference or loss of acoustic position referencing for the Discoverer Enterprise and the DD III.**

Note that any noise issues degrading the acoustic position reference system *MUST* be reported to the OIM and the Well Site Leader. Under no circumstance should the acoustic system be disabled because of degraded signal to noise ratio. Disabling the acoustic system would bring the rig from a DP Class II to a DP Class I DP operation.

3.2 Safe Distance

The Frequency Management Plan assumes there is no safe distance where acoustics will not interfere, especially with the short distance between vessels. The plan produced a set of compatible channel allocations and guidelines that will allow each vessel to operate freely without concern as to the effect on other vessels nearby.

3.3 Echo Sounder Turnoff

Any vessels entering the MC-252 Incident area must turn off the echo sounders within 5-nm of arriving in the MC-252 Incident field. This is to ensure echo sounders do not create noise in the water column and interfere acoustically with any of the vessels using acoustic communications. Do not turn on echo sounders until the vessel is outside this 5-nm limit.

Caution:	**Compliance with the echo sounder turnoff while in the MC-252 Incident field is mandatory.**

It is the responsibility of each MC-252 Incident group contracting vessels, the Logistics Group and the Fourchon Base to notify and inform the MC-252 Incident vessels of the Echo Sounder turnoff requirements.

3.4 Acoustic Frequency Coordination

3.4.1 Coordination of Acoustic Activities

All information, regarding the coordination of the MC-252 Incident Acoustic Frequency Management Plan, is directed to the respective rig's Team Leader.

Jonathan Davis with BP, Dave Ross with UTEC Survey, together with Kongsberg and Sonardyne, will assist in troubleshooting frequency clashes and interferences (see phone list for contact details).

3.5 Acoustic Equipment Use Notifications

Source vessels will work in close proximity to the Discoverer Enterprise and the DD III. These vessels must follow the Frequency Management Plan and the acoustic guidelines before enabling acoustic equipment.

3.5.1 Acoustic Field Operations

For acoustic operations at MC-252 Incident, vessels will inform the DEN and the DD III Bridge of arrival in the field. The following must take place prior to commencement of acoustic operations:

- Confirm field arrival and departure.
- Confirm all frequencies in use by the Discoverer Enterprise and the DD III as per Table 6, page 22.
- Confirm pre-approved acoustic channel allocations for the upcoming operation.
- Advise the Discoverer Enterprise and DD III of minimum proximity requirements between vessels.
- Advise the Discoverer Enterprise and DD III DPO when channels are enabled and disabled.
- Advise the Discoverer Enterprise and DD III DPO of source vessel channel selections.
- Be prepared to immediately disable acoustic channels in case of degradation of the Discoverer Enterprise and the DD III acoustic position reference systems.
- Discoverer Enterprise and DD III to advise vessel of any acoustic position reference system response and degradation from the added acoustics in the water column.

Caution:	**No vessel shall deploy transponders without first contacting the DEN and the DD III DPO and receiving confirmation as to channels in use. The DEN and the DD III and any vessels using acoustics will be in continuous communications concerning acoustic noise and frequency clashing.**

3.6 Fan Beam

Fan Beam is a position reference system used while vessels are in proximity. Workboats and supply boats, as well as vessels carrying out subsea construction, utilize Fan Beam. The system's maximum range is 2,000-m with an accuracy of $\pm$10 cm during optimum conditions. The system uses a laser beam and is, therefore, weather sensitive. The practical range for Fan Beam is in the range of 200-m to 400-m.

The key to a successful operation of the Fan Beam position reference system is to ensure the system is maintained, fully operational and in Green status and that the Fan Beam is set up according to the manufacturer's specifications.

Particular attention is required to the system setup. The gating parameters must be set correctly to ensure the intended target is followed. This may have been a problem in the past. There are known instances where the laser beam has locked onto a moving object onboard the adjacent vessel. The moving object may have been someone in coveralls with reflective tape.

Note: Any vessel working the MC-252 Incident area and using Fan Beam as a relative position reference system, must confirm that the system is operational according to manufacturer's specifications before the system is allowed to be used near the DEN, the DD III.

The Fan Beam User Guide v. 4.1 is listed as a reference in this document. *The user, however, shall always check with the manufacturer to ensure the correct and latest version of the user guide is utilized for setting up the Fan Beam systems on the particular vessel*.

The MC-252 Incident vessels have their Fan Beam laser units installed at different heights. Adjustments may be required in the height of the prisms installed on the Discoverer Enterprise and the DD III to conform to vessel requirements.

The Discoverer Enterprise and the DD III OIM should determine correct prism height and location based on communications with the respective user of Fan Beam systems. Table 4, page 20 lists the Fan Beam height for some vessels which may be used at MC-252 Incident.

Table 4: Fan Beam Height

MC-252 Incident Vessels	Fan Beam Height Above Sea Level	Ideal Reflector Height above Sea Level
		The reflector height is determined by the application and distance between vessels and is generally set at Fan Beam height -0 +17-ft.
Schlumberger DeepSTIM II	44-ft.	
Technip Deep Blue	102-ft.	
OI1	56-ft.	
OI3	74-ft.	
C-Captain	45-ft.	

There is a wide variation in Fan Beam installation heights between vessels. The Fan Beam prisms, installed on the DEN and the DD III, will require elevation and position changes, depending on which vessel is utilizing the system. Adjusting the height will improve the system performance and reduce Fan Beam positioning errors.

Table 5 below lists the MC-252 Incident vessels using Position Reference systems.

Table 5: Vessels using Position Reference Systems

MC-252 Incident Vessels	Available Position Reference System	Notes
Discoverer Enterprise	DGPS, Acoustics (Sonardyne digital)	DP Class II+
DD III	DGPS, Acoustics (HiPAP)	DP Class II+
Source control vessels	DGPS, Fan Beam and RADius. Acoustics for tracking and surveying	DP Class I and II Some vessels may not have been assessed for DP class
Spill clean-up vessels		Not assessed for DP class

3.7 RADius Position Reference System

The RADius position reference system measures relative distance between two adjacent vessels using the Doppler principle. The adjacent vessel is equipped with RADius transponder(s). The system has a range of approximately 1,100-m and is not affected by activities onboard the adjacent vessel. A transponder system consisting of a small box is installed onboard the host vessel (i.e., Discoverer Enterprise and DD III). The system requires a 120-volt power source. Range accuracy is 0.25-m.

Note: Any vessel, working the MC-252 Incident area and using RADius as a relative position reference system, must confirm that the system is operational according to manufacturer's specifications before the system is allowed used near the Discoverer Enterprise and the DD III.

Table 6: MC 252 Acoustic Allocation Summary

DP		
DD III DP	b31	DP
	b32	DP
	b35	DP
	b37	DP
	b73	DP
	b76	DP LIC

ROV System		
DD III	b14	Tracking
	b28	Tracking
	b34	Tracking
	b48	Tracking
	b54	Tracking
	b68	Tracking
	b74	Tracking

DO NOT USE
b12
b13
b15
b17
b51
b52
b53
b57
b71
b72
b75

Discoverer Enterprise DP array: Sonardyne wideband Family 14, CIS. Ch. 1409, 1410, 1411, 1412, 1413

BOA SUB C	b18	SPARE
	b24	CRANE 1
	b26	DP 1
	b38	MILL 36
	b46	SPARE
	b58	MILL 36 SPARE
	b64	CRANE 2
	b78	MILL 37
	b84	MILL 37 SPARE
	b86	DP 2

MISS GINGER	b27	Emergency AUV
	b42	AUV
	b47	SPARE
	b62	SEABIRD
	b67	SPARE
	b82	SPARE
	b87	SPARE

SKANDI NEPTUNE	b21	Tracking
	b25	Tracking
	b41	Tracking
	b45	Tracking
	b61	Tracking
	b65	Tracking
	b81	Tracking
	b85	Tracking

OI 3	b16	Tracking
	b23	Tracking
	b36	Tracking
	b43	Tracking
	b56	Tracking
	b63	Tracking
	b83	Tracking

	Wideband Family 12 (see below)	
OI-3	Address 1201, CIS 1	ROV 1
	Address 1202, CIS 2	ROV 1 Cage
	Address 1203, CIS 3	ROV 2
	Address 1204, CIS 7	ROV 2 Cage

	Wideband Family 15 (see below)	
C-Express	Address 1512, CIS 4	ROV
	Address 1513, CIS 5	ROV Backup
	Address 1514, CIS 6	ROV TMS

The acoustic allocations for all construction vessels are found in Figure 10, page 34, Figure 11, page 35 and Figure 12, page 35.

It is imperative that the plan is adhered to and that there are no changes without preapproval.

The DD III ROV channels may be utilized bby others if not required by the DD III operation.

CIC = Common Interrogation Signal

4 SIMOPS Events

4.1 SIMOPS Events

The SIMOPS plan contains multiple events and interfaces between the Discoverer Enterprise at relief well location RxC and DD III at relief well location RxD.

Anticipated SIMOPS events are:

- Discoverer Enterprise operating at relief well location RxC and DD III at relief well location RxD.
- Source control vessel activity inside the Discoverer Enterprise and the DD III 500-m exclusion zones.
- Source control vessel activity alongside the Discoverer Enterprise and the DD III.
- Spill clean-up vessel activity inside the Discoverer Enterprise and the DD III 500-m exclusion zones.
- Pumping vessel alongside Discoverer Enterprise or DD III.
- Salvage operations.
- Barge and tug boats.
- Aviation.
- In-situ burns (requires separate risk assessment and approval).

Note: There is no requirement to develop a separate SIMOPS procedure for any of the MC-252 SIMOPS events. Detailed project operating procedures specifically developed in conjunction with and referring to the MC-252 SIMOPS plan are required.

Table 7: SIMOPS Preplanning General Checklist

Activity	Well Site Leader	OIM	DPO
Vessel within 500-m of DEN and DD III.	To be informed and approve arrival.	Approve.	Prepare DEN and DD III most favorable heading. Ensure communications to vessel are as planned.
In close proximity to, alongside or equipment hooked up to DEN/DD III.	To be informed.	Approve through Permit to Work (PTW) process.	Ensure communications to vessel are as planned.
Station-keeping alongside.	To be informed of met-ocean conditions and any heading change of DEN/DD III and vessel in SIMOPS.	To be informed of met-ocean conditions and any heading change of DEN/DD III and vessel in SIMOPS.	Communicate with vessel in SIMOPS on all DP matters.
Fan Beam prism installation.	To be informed of station-keeping readiness.	To determine correct height based on vessel alongside.	Ensure fully operational.
Degradation in station-keeping ability of vessel(s).	To decide on further action together with OIM.	Vessel Captain together with DEN/DD III OIM and DPO to assess and decide on action according to WSOC.	
SIMOPS with other operations	To be informed.	To approve.	Requirements as above.

4.2 Emergencies during SIMOPS Events

Emergencies onboard one of the vessels involved in SIMOPS impact the ability to proceed with SIMOPS. The SIMOPS planning should specifically address emergencies during SIMOPS events, mitigations and restrictions associated with such emergencies.

Use the following guidelines to shut down or postpone the SIMOPS event, which may reduce the ability of personnel to respond effectively to an emergency:

- Sheen, plume or surface debris that could impact the SIMOPS event.
- Any condition the OIM, Captain or the BP Well Site Leader determines to exist or develop and which would compromise safety of crews, equipment or vessels during the SIMOPS execution.
- Any event where acoustics communications are interfering with station-keeping of any vessel.
- Any fire requires vessels to suspend activities except those required to handle the event.
- Any hull emergency requires vessels to suspend activities except those that are required to handle the event.
- Any loss of firewater pumps requires vessel to suspend all activities at a secure point.
- Any loss of communication requires vessels to suspend all activities at a secure point.
- Any met-ocean event that could jeopardize station-keeping or operations during the SIMOPS event.
- Any event that takes a vessel out of readiness condition such as power, cooling and fuel systems, power management system, position reference systems and DP system.

4.3 SIMOPS Approval

The complexity of the SIMOPS activity determines the level of approval required for the work plan. Use the following procedure as a guideline:

- The SIMOPS Director has the overall responsibility for determining SIMOPS priorities and give necessary approvals following review with Branch Directors and Air Command.
- The SIMOPS Branch Directors approve SIMOPS events within their fleet after review with the SIMOPS Director and the respective vessels.
- The vessel OIM / Captain approves SIMOPS events associated with the respective vessel.
- The BP Well Site Leader, with input from the respective OIMs and Branch Directors determine the level of authority required to approve a safe work plan for a more complex activity inside the Discoverer Enterprise and the DD III 500-m zones.

5 Dropped Objects Prevention

5.1 Drilling Vessels

Any dropped object is to be reported through regular channels. There are no infrastructure concerns at the respective well sites. There are a number of pipelines and wellheads in the area, so dropped object prevention must have the same focus as when working in any of BP's fields.

5.2 Source Vessels and Marine Clean-up Vessels

Any dropped object must be reported as per the Incident Notification Chart. The Discoverer Enterprise and the DD III Bridges should be notified as well on any dropped object incident.

Caution:	**Vessels inside the MC-252 Incident field MUST promptly report a dropped object incident to the DEN and the DD III Bridge.**

6 Area Vessel Control and Aviation

The key to vessel control is through good communications. The daily SIMOPS call is the main venue to inform of upcoming vessel activities and requirements.

6.1 Surface Conditions

Marine debris and hydrocarbons will to a large extent determine activities at MC-252 Incident. An assessment is being made on DEN and DD III operability while being exposed to a surface sheen or the plume. Daily updates on sheen and plume developments together with marine debris updates are provided to ensure appropriate marine decisions can be made.

6.1.1 Sheen and Plume

It is likely that the DEN and the DD III will be exposed to a sheen or the plume. This depends on met-ocean conditions and the volume of hydrocarbon (HC) being released. The DEN and the DD III bridges will stay in communications with the Spill clean-up vessels and be notified of any changes in weather patterns that may result in HC reaching the well sites.

6.1.2 Marine Debris

Discovery of marine debris will be broadcasted to the fleet by the first observer. Recovery will be handled by the appropriate team as required.

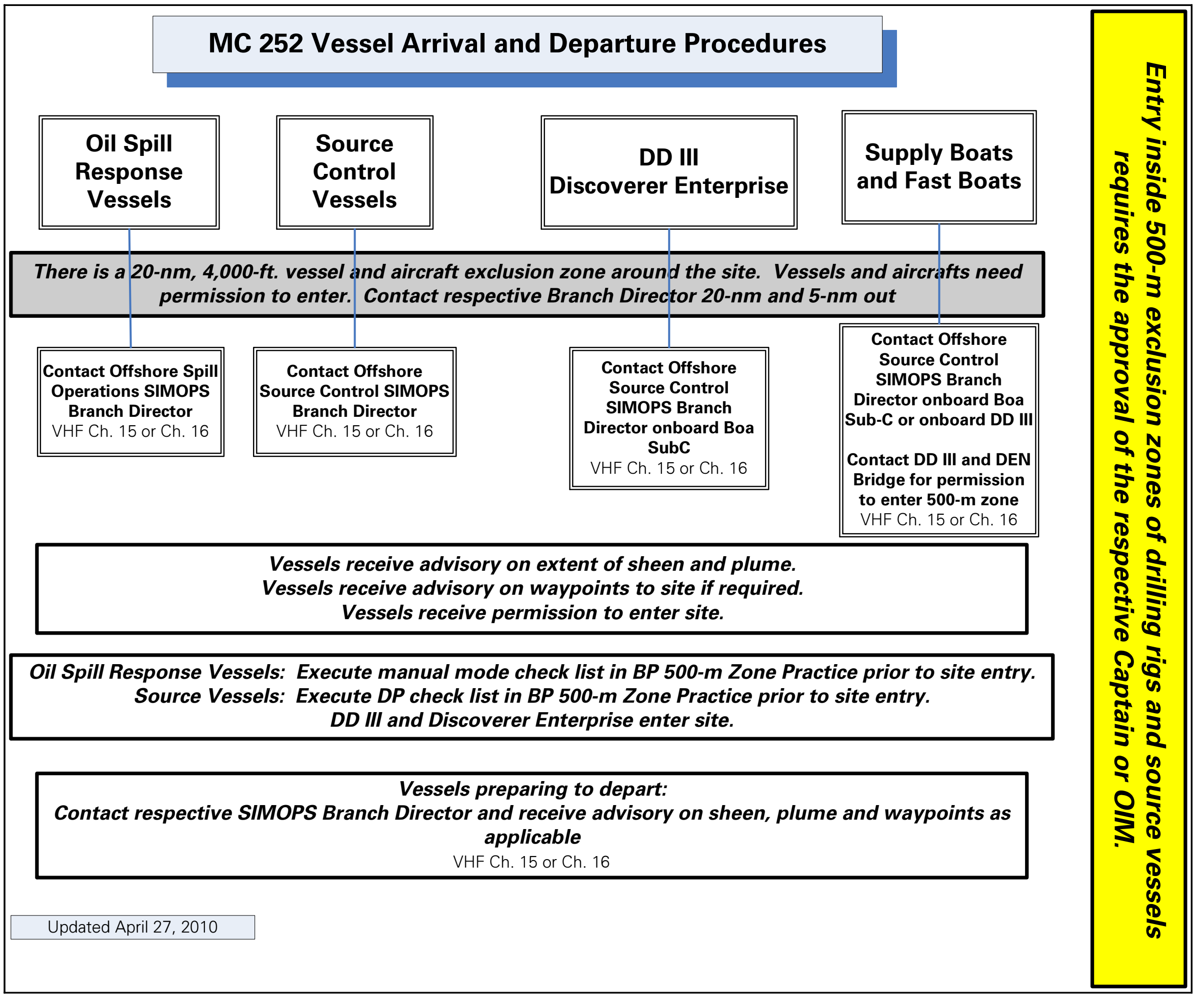
6.2 Vessel Arrival at MC-252 Incident

Surface and marine debris conditions determine how vessels arrive at the MC-252 Incident site. A Marine Debris Exclusion Zone map in Figure 7, page 32.

6.2.1 Arrival and Departure Procedures at MC-252 Incident

Vessel arrival and departure will follow the procedures set up in Figure 4, page 27. The number of vessels on DP and connected to the seabed either trough drilling risers or ROVs requires careful planning of vessel movements.

Figure 4: Vessel Arrival and Departure Procedures



6.3 Drilling Vessels

The DD III and the DEN are arriving from the SW and will move on to location from the standby and staging area once receiving approval through the Team Leader.

6.3.1 Staging Area

The DD III and the Discoverer Enterprise will move to the Staging and Standby area in MC 339 as shown in Figure 5, page 30. Preparations to start operations may be carried out at this location until approval is received for moving to the well location or the standby area to the south of the well location (see next section).

6.3.2 Standby Area

The DD III and the Discoverer Enterprise will move to the Standby area from the Staging area where operations will commence. The Standby areas are located 3,000-ft. to the south of the relief well locations RxC and RxD as seen in Figure 7**,** page 32. Conductor and tubulars may be deployed at this point.

The Standby areas are approximately half distance between the well centers and the ENI pipeline to the south (see **Figure 7**, page 32).

6.4 Source Control Vessels

Source vessels will be directed through the Incident management Command and are not expected to interact with the Discoverer Enterprise and the DD III to any extent.

The Discoverer Enterprise and the DD III 500-m exclusion zones will be adhered to. Entry into any of these zones requires Discoverer Enterprise or DD III OIM approval.

Please note that the Discoverer Enterprise and the DD III 500-m exclusion zones overlap. Any passage between the two rigs will, therefore, require Discoverer Enterprise and DD III OIM approval.

6.5 Oil Spill Response Vessels

Oil spill response vessels will be directed through the Incident Management Command via the SIMOPS Branch Director and are not expected to interact with the Discoverer Enterprise and the DD III unless the plume direction changes to the south.

It is essential that the Discoverer Enterprise and the DD III are notified of any clean-up vessel activity in the vicinity of the well operations and especially inside the rigs 500-m exclusion zones.

Note: The Discoverer Enterprise and the DD III 500-m exclusion zones will be adhered to. Entry into any of these zones requires Discoverer Enterprise or DD III OIM approval. Please note that the DEN and the DD III 500-m exclusion zones overlap. Any passage between the two rigs will, therefore, require Discoverer Enterprise and DD III OIM approval.

6.6 Hailing Channels VHF 15 and VHF 16

All vessels approaching the Discoverer Enterprise and the DD III will use VHF channels 15 and channel 16 to call up the Discoverer Enterprise or the DD III Bridge.

6.7 Working Channels

Once the targeted rig or vessel is hailed, the channel is switched to an agreed frequency as per Section 2.7, page 16.

6.8 GoM 500-Meter Zone Practice

Any vessel entering the 500-m exclusion zone of any MC-252 Incident vessel shall comply with the requirements in the 500-m Zone Practice. The document is issued by the BP Marine Vessel Operations group.

The nature of the MC-252 Incident operation, however, requires flexibility in how vessels interact. It is anticipated that the Captains on the Source Control vessels and the Spill clean-up vessels review proximity requirements between vessels and have an agreement in place concerning procedures and safeties.

Entry into the DEN and the DD III 500-m exclusion zones, however, takes place according to the 500-m Zone Practice.

Caution:	**Critical vessel repairs and maintenance shall be performed either before or after the SIMOPS event. No critical repairs will be performed during the SIMOPS event (see details in the 500-m Zone Practice). A critical repair is defined as repair that could lead to single point failure and loss of station or vessel integrity.**

6.9 Aviation

The air command in Houma is an integrated part of the SIMOPS plan. The following types of air activities are expected:

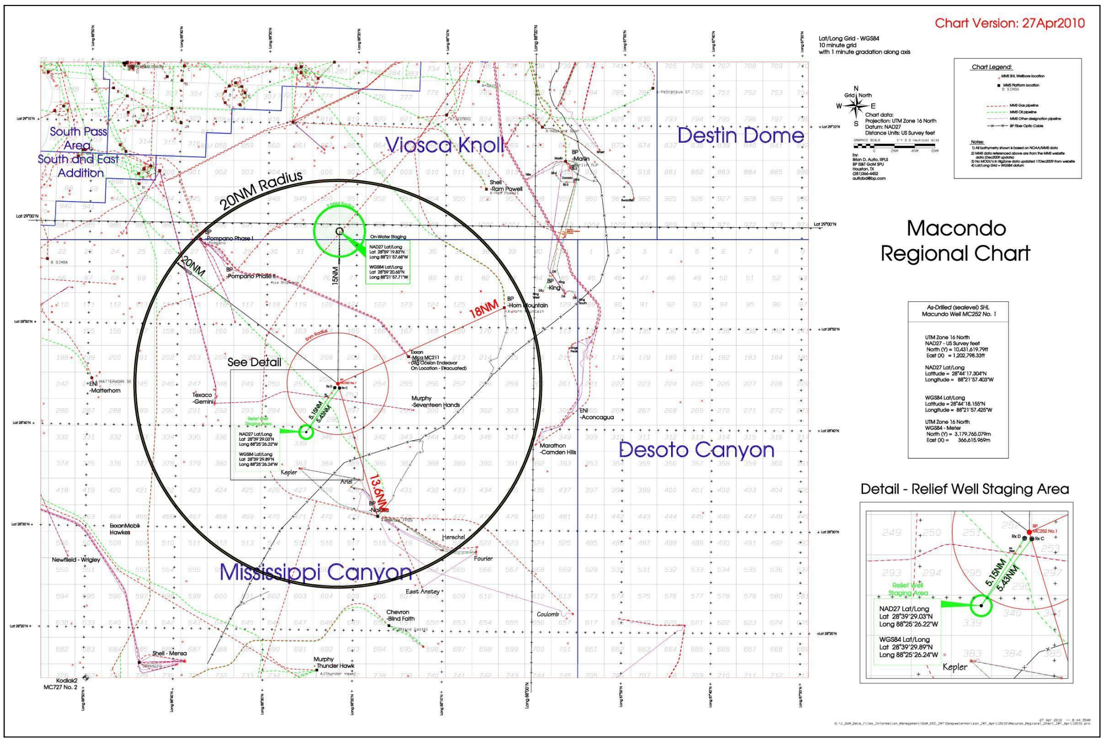
1. Helicopter crew flights to drilling rigs and source control vessels.
2. Spotter planes and fixed wing surveillance
3. Areal spray of dispersants (four aircrafts in one dispersant sortie, four to five sorties per day).
4. Over-flights of fixed wing and helicopters.
5. Drone surveillance.
6. Press and media.

The MC252 area has a restricted airspace (TFR – Temporary flight restriction) of 20-nm from site up to a 4,000-ft. elevation. Flights inside this zone are controlled by the USCG cutter Harriet Lane on site. The air command in Houma plans all flights to the site and reports through the SIMOPS Director as shown in Figure 1, page 8.

6.10 Helicopter Fueling

Helicopter fueling operations will mainly take place onshore. The aviation group will arrange emergency fueling onboard offshore facilities if needed. It is emphasized, however, that using the Discoverer Enterprise and the DD III as fueling stations for non rig flights reduces the efficiency of the drilling operations because of shut-down of cranes and deck activities.

Figure 5: MC-252 Incident Regional Chart With 20-nm Restricted Zone



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Security Classification:	Project Confidential	Page:	Page 30 of 46

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Figure 6: MC-252 Incident Marine Debris Map

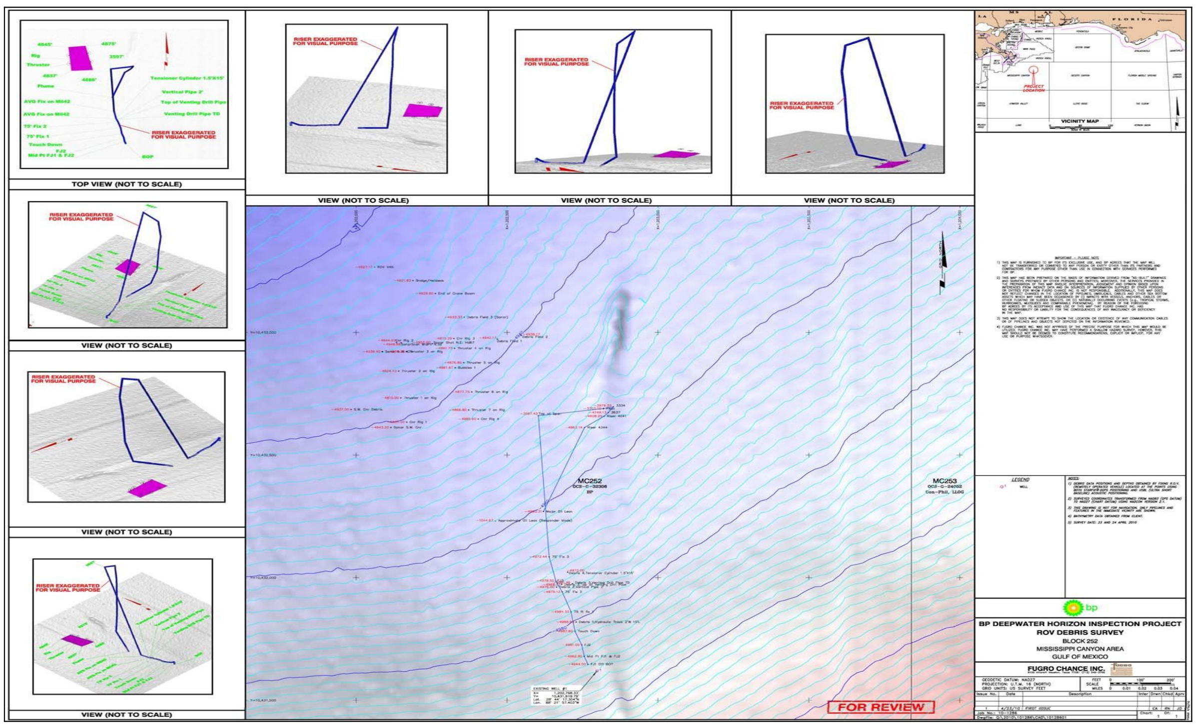


Figure 7: Marine Debris and Discoverer Enterprise / DD III 500-m Exclusion Zones

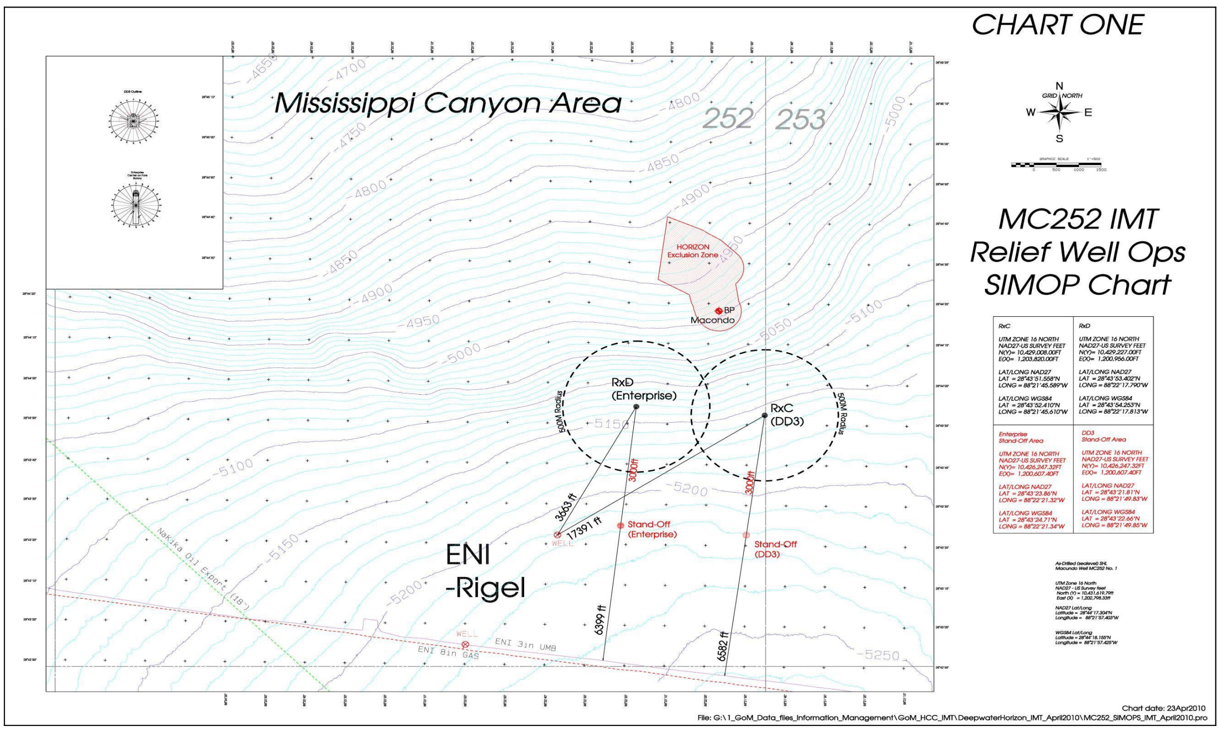
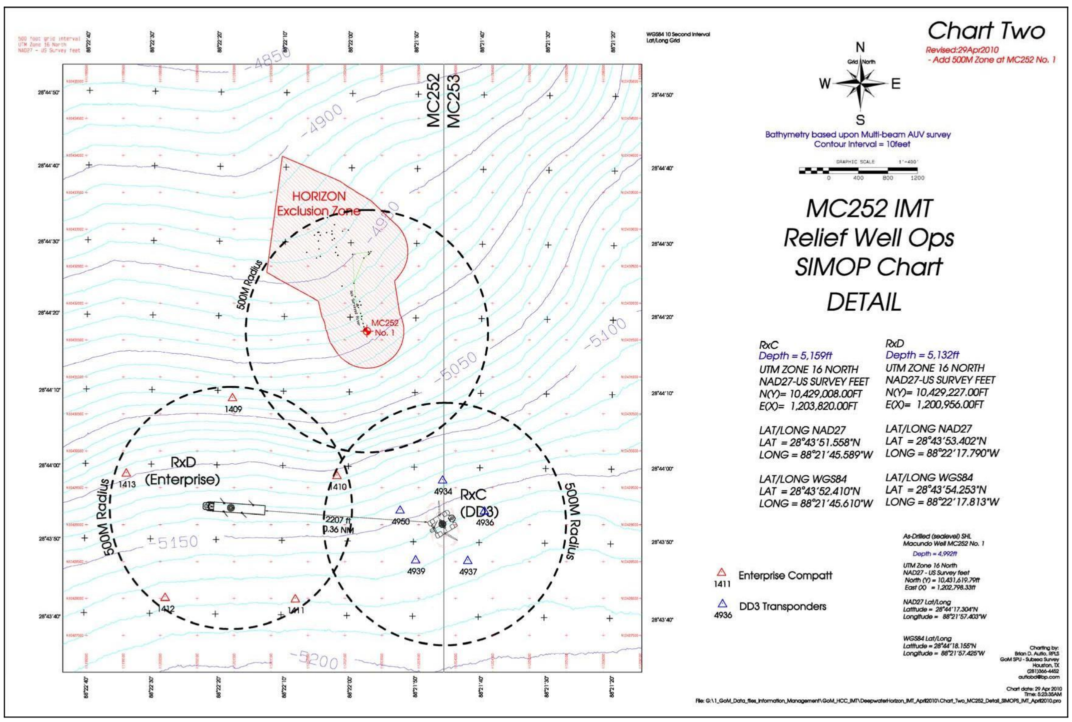


Figure 8: 500-m Vessel Exclusion Zone Detailed Map



Note: The Offshore Vessel Source Control SIMOPS Coordinator controls the debris field and an area within appr. 1,000-m of the MC 252 no. 1 well site.

Figure 9: Discoverer Enterprise and DD III Transponder Grids

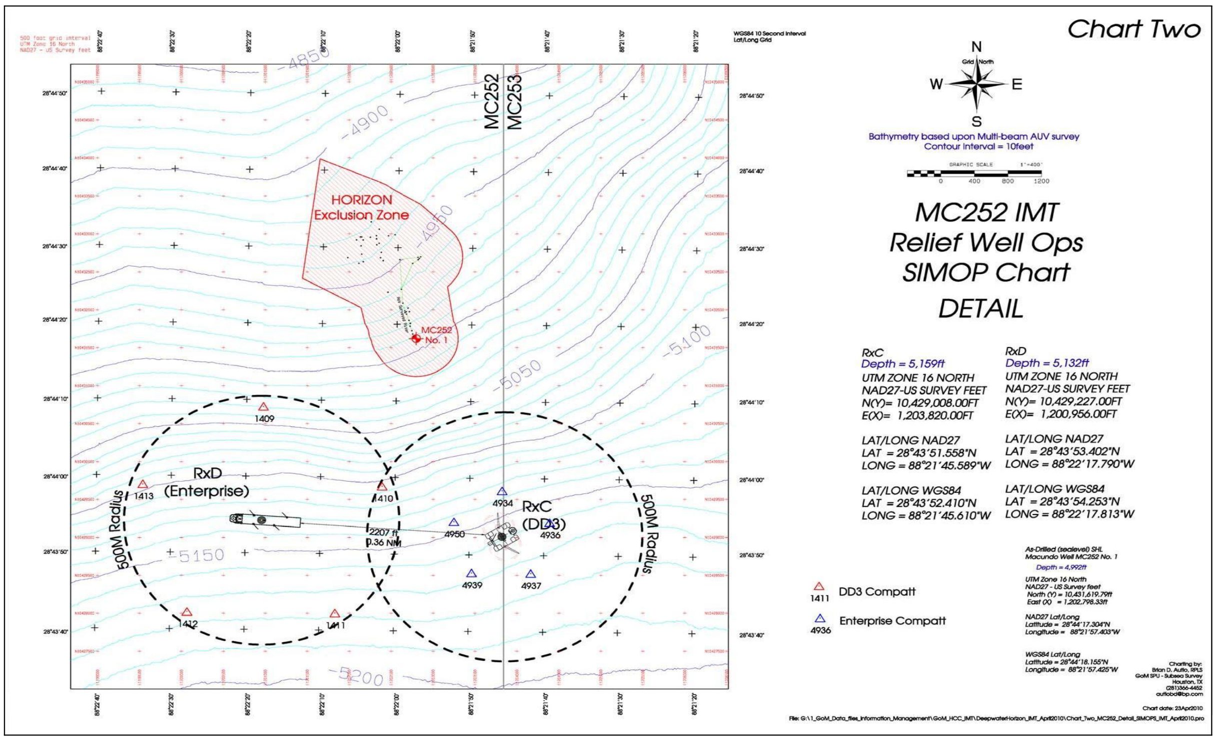


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Figure 10: Field Frequency Management Plan HiPAP vs. Sonardyne Digital

1. Discoverer Enterprise DP Array is now operating with Sonardyne MK5 Wideband COMPATTs. The array is setup for Family 14 ; C00.
LBL arrays installed at Thunder Horse must avoid allocating this family to remain clash free with the Discoverer Enterprise.

KONGSBERG HiPAP						SONARDYNE TONE CHANNELS																		
VESSEL ALLOCATION	CH #	OPERATING CONDITIONS / PARAMETERS	TX1	TX2	RX	CH1 19230	CH2 19841	CH3 20491	CH4 21186	CH5 21929	CH6 22522	CH7 23148	CH8 23810	CIF 24752	CCF 25510	CRF 26042	CH0 26882	CH9 27472	DCF 28090	CH10 28735	CH11 29411	CH12 30120	CH13 30864	CH14 31645
DO NOT USE	b12	DO NOT USE	21000	21500	29250				X												X			
DO NOT USE	b13	DO NOT USE	21000	22000	29750				X	X														
DD III (VESSEL 3)	b14	Tracking	21000	22500	30250				X		X											X		
DO NOT USE	b15	DO NOT USE	21000	23000	30750				X			X											X	
OI 3 (VESSEL 4)	b16	TRACKING	21000	23500	27250				X									X						
DO NOT USE	b17	DO NOT USE	21000	24000	27750				X				X					X						
BOA SUB C (VESSEL 1)	b18	SPARE	21000	24500	28250				X					X					X					
SKANDI NEPTUNE (VESSEL 5)	b21	TRACKING	21500	21000	28500				X											X				
OI 3 (VESSEL 4)	b23	TRACKING	21500	22000	29500					X											X			
BOA SUB C (VESSEL 1)	b24	CRANE 1	21500	22500	30000						X											X		
SKANDI NEPTUNE (VESSEL 5)	b25	TRACKING	21500	23000	30500							X												
BOA SUB C (VESSEL 1)	b26	DP 1	21500	23500	27000												X							
MISS GINGER (VESSEL 2)	b27	EMERGENCY AUV	21500	24000	27500								X					X						
DD III (VESSEL 3)	b28	Tracking	21500	24500	28000									X					X					
DD III DP	b31	DP	22000	21000	28750				X	X										X				
DD III DP	b32	DP	22000	21500	29250					X											X			
DD III (VESSEL 3)	b34	Tracking	22000	22500	30250					X	X											X		
DD III DP	b35	DP	22000	23000	30750					X		X											X	
OI 3 (VESSEL 4)	b36	TRACKING	22000	23500	27250					X								X						
DD III DP	b37	DP	22000	24000	27750					X			X					X						
BOA SUB C (VESSEL 1)	b38	MILL 36	22000	24500	28250					X				X					X					
SKANDI NEPTUNE (VESSEL 5)	b41	TRACKING	22500	21000	28500				X		X									X				
MISS GINGER (VESSEL 2)	b42	AUV	22500	21500	29000						X									X				
OI 3 (VESSEL 4)	b43	TRACKING	22500	22000	29500					X	X										X			
SKANDI NEPTUNE (VESSEL 5)	b45	TRACKING	22500	23000	30500						X	X												
BOA SUB C (VESSEL 1)	b46	SPARE	22500	23500	27000						X						X							
MISS GINGER (VESSEL 2)	b47	SPARE	22500	24000	27500						X		X					X						
DD III (VESSEL 3)	b48	Tracking	22500	24500	28000						X			X					X					
DO NOT USE	b51	DO NOT USE	23000	21000	28750				X			X								X				
DO NOT USE	b52	DO NOT USE	23000	21500	29250							X									X			
DO NOT USE	b53	DO NOT USE	23000	22000	29750					X		X												
DD III (VESSEL 3)	b54	Tracking	23000	22500	30250						X	X										X		
OI 3 (VESSEL 4)	b56	TRACKING	23000	23500	27250							X						X						
DO NOT USE	b57	DO NOT USE	23000	24000	27750							X	X					X						
BOA SUB C (VESSEL 1)	b58	MILL 36 SPARE	23000	24500	28250							X		X					X					
SKANDI NEPTUNE (VESSEL 5)	b61	TRACKING	23500	21000	28500				X											X				
MISS GINGER (VESSEL 2)	b62	SEABIRD	23500	21500	29000															X				
OI 3 (VESSEL 4)	b63	TRACKING	23500	22000	29500					X											X			
BOA SUB C (VESSEL 1)	b64	CRANE 2	23500	22500	30000						X											X		
SKANDI NEPTUNE (VESSEL 5)	b65	TRACKING	23500	23000	30500							X												
MISS GINGER (VESSEL 2)	b67	SPARE	23500	24000	27500								X					X						
DD III (VESSEL 3)	b68	Tracking	23500	24500	28000									X					X					
DO NOT USE	b71	DO NOT USE	24000	21000	28750				X				X							X				
DO NOT USE	b72	DO NOT USE	24000	21500	29250								X								X			
DD III DP	b73	DP	24000	22000	29750					X			X											
DD III (VESSEL 3)	b74	Tracking	24000	22500	30250						X		X									X		
DO NOT USE	b75	DO NOT USE	24000	23000	30750							X	X										X	
DD III DP	b76	DP LIC	24000	23500	27250								X					X						
BOA SUB C (VESSEL 1)	b78	MILL 37	24000	24500	28250								X	X					X					
SKANDI NEPTUNE (VESSEL 5)	b81	TRACKING	24500	21000	28500				X					X						X				
MISS GINGER (VESSEL 2)	b82	SPARE	24500	21500	29000									X						X				
OI 3 (VESSEL 4)	b83	TRACKING	24500	22000	29500					X				X							X			
BOA SUB C (VESSEL 1)	b84	MILL 37 SPARE	24500	22500	30000						X			X								X		
SKANDI NEPTUNE (VESSEL 5)	b85	TRACKING	24500	23000	30500							X		X										
BOA SUB C (VESSEL 1)	b86	DP 2	24500	23500	27000									X			X							
MISS GINGER (VESSEL 2)	b87	SPARE	24500	24000	27500								X	X				X						

Figure 11: HazID Rig Exposure to Oil Sheen or Plume Rig Operations

Phase	Hazard	Hazard Scenario	Causes	Consequences	Safeguards	Severity Safety	Severity Environmental	Severity Financial	Severity Reputation	Pre-Mitigation Frequency	Pre-Mitigation Safety	Pre-Mitigation Environmental	Pre-Mitigation Financial	Pre-Mitigation Reputation	Risk	Actions / Mitigation Measures	Severity Safety	Severity Environmental	Severity Financial	Severity Reputation	Post-Mitigate Frequency	Post-Mitigate Safety	Post-Mitigate Environmental	Post-Mitigate Financial	Post-Mitigate Reputation	Risk	Assigned Individual	Dates	Comments
						-	-	-	-								-	-	-	-									
Operating Rig	Oil Sheen	The results of the TOI internal HAZID were reviewed and accepted by the team. Included as a separate logsheet.				-	-	-	-							*No additional mitigations recommended.*	-	-	-	-									Note; the rig vessel master will have a conversation with the source vessels in field on their experience working the area with an oil sheen.
						-	-	-	-								-	-	-	-									Note: Vessels need a plan to flush ballast tanks prior to incident demobilization to remove any oily water in ballast tanks.
	Plume	Plume of concentrated oil comes up right under the rig.	Flow increases to a catastrophic rate. A potential cause, among others, could be failure of BOP stack.	environmental, financial.	Subsea visual, real time, monitoring of the well site area (three vessels with multiple ROV's). Existing TOI emergency procedures.	D	-	E	-	3	D3		E3			Develop a decision matrix for various scenarios of increased oil flow that could impact the drill rig.	E	-	E	-	3	E3		E3			George Gray		No
																Include in IAP that source control immediately communicates any flow changes to the SIMOPS Director											Troy Endicott		
																Develop a model to predict plume location based on subsea currents. Consider the impact of rapidly increasing flow rate.											Troy Endicott		Note: The rig response is partially based on having knowledge of expected plume location.
	Emulsion / Mousse					-	-	-	-							Determine the location and density of oil/water emulsion / mousse floating below the surface.	-	-	-	-							Troy Endicott		Note: The rig response is partially based on having knowledge of expected location of any emulsion/mousse.
						-	-	-	-							Convey IMT air monitoring and safety plan to the vessels.	-	-	-	-							Joe Neumeyer		
						-	-	-	-								-	-	-	-									

Figure 12: HazID Rig Exposure to Oil Sheen or Plume Other Issues

						Severity				Pre -Mitigation							Severity				Post -Mitigate								
Phase	Hazard	Hazard Scenario	Causes	Consequences	Safeguards	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Actions/Mitigation Measures	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Assigned Individual	Dates	Comments
						-	-	-	-								-	-	-	-									
Moving to relief well sites	No unique hazards identified.				SIMOPS Plan is guidance document for green light to move in.	-	-	-	-								-	-	-	-									
					AUV survey to confirm no interferences at the relief well sites.	-	-	-	-								-	-	-	-									
Met ocean					Seasonably favorable winds and currents should keep slick away from rigs.	-	-	-	-								-	-	-	-									
					Historically loop currents move away from relief well drill locations. Loop currents are monitored daily.	-	-	-	-								-	-	-	-									
		Hurricane			Existing hurricane plans.	-	-	-	-								-	-	-	-							Troy Endicott		
Source Control vessels		Lose ROV and view of source			Three vessels with ROV's are onsite.	-	-	-	-								-	-	-	-									
						-	-	-	-								-	-	-	-									
		Acoustic conflict			SIMOPS plan defines resolution process.	-	-	-	-								-	-	-	-									
Vessels in 500 meter zone		Spill response vessels moving into the rig 500 meter zone			SIMOPS plan includes 500 meter zone requirement.	-	-	-	-							Send 500 meter zone to branch directors.	-	-	-	-							Troy Endicott		Note: The spill response vessels may be less familiar with the 500 meter zone practice. It is also in the SIMOPS Plan.
	Dead vessel	Vessel in the area has blackout	equipment failure	Potential vessel collision	SIMOPS plan includes 500 meter zone requirement.	-	-	-	-								-	-	-	-									
	NGO's, media				Vessel security plans, JIC (joint information center) to support communications.																								
		Oil washes on deck of supply boat going to the rig.			Supply boats avoid transit through oil slick if possible. They are offloaded on the lee side of the rig and have existing cleaning procedures. Note: the supply vessels have decon procedures for leaving the area.	-	-	-	-								-	-	-	-									
Dispersant Application					Rigs would have little if any exposure. Airspace is managed outside the rigs.											Communicate to the IMT the drill rigs request to maintain a minimum of one mile distance for dispersant application or in situ burning.											Troy Endicott		
In situ burn					Burning is not planned to be done close to the rigs.																								

Figure 13: HazID Log Rig Exposure to Oil Sheen or Plume

HAZID Log

Node 1 : DDIII & DEN operating on Macondo (MC 252)

Operation	Hazard	Preventive Controls	Consequences	Mitigating Controls	Risk Ranking: Personnel	Risk Ranking: Loss of Containment	Risk Ranking: Property Damage	Risk Ranking: Risk	Additional Safeguards	Residual Risk: Personnel	Residual Risk: Loss of Containment	Residual Risk: Property Damage	Residual Risk: Risk	Comments
Operating rig with oil sheen present.	Oily water sucked up into thruster chiller units.	Ballast down as low as reasonably practicable. DDIII: Ballast down to Operating draft prior to moving onto MC 252. Take samples through strainers during rounds.	DEN: Overheating and going into power reduction mode. DDIII: Minimal exposure.	DEN: Continuously monitored. Can isolate 1 aft and 1 fwd while being serviced depending on the weather. DDIII: Continous monitoring. 2 independent loops w/ 3 heat exchangers each. Can put ones needing to be serviced on standby. Can monitor pressure & temperature differential via VMS. Can acid wash offline heat exchanger.			Ent B4 DD III B4							
	Oily water in heat exchangers (thruster motor, main engines, rig air compressor, thruster steering, thruster lube oil, AC units)	Ballast down as low as reasonably practicable. DDIII: Ballast down to Operating draft prior to moving onto MC 252. Take samples through strainers during rounds.	DEN: Overheating and potential engine shutdown. DDIII: Minimal exposure.	DEN: Continuously monitored. Has 2 SW cooled Heat Exchangers for Main Engines. 1 as spare, and 1 as backup. DDIII: Continous monitoring. 2 independent loops w/ 3 heat exchangers each. Can put ones needing to be serviced on standby. Can monitor pressure & temperature differential via VMS. Can acid wash offline heat exchanger.			Ent B4 DD III B4							
	Oily water in drawworks cooling unit.	Ballast down as low as reasonably practicable. DDIII: Ballast down to Operating draft prior to moving onto MC 252. Take samples through strainers during rounds.	Drawworks cooler unit overheating.	DDIII: 3 individual heat exchangers for Drill Floor equipment. Can take 1 offline to clean. DEN: Has 2 for DWX cooling. Can monitor and service while 1 offline.			Ent B4 DD III B4							

7 References

7.1.1 BP

- MC-252 Incident Offshore Coordination SIMOPS Guidelines

7.1.2 Transocean (TOI)

- See TOI DEN and DD III HSE Plans
- TOI WSOC for DEN and DD III
- TOI Operations Manual
- TOI Floating Operations Manual HQS-OPS-004, Section 4, Subsection 11: DP Operations Guidelines – Close Proximity Operations.
- DEN DP Capability Plots
- Development Driller III DP Capability Plots

7.2 Other References

7.2.1 BP

- GoM MC-252 Incident Management of Change Plan
- BP GoM TOI HSE Management System Bridging Document
- Emergency Response Plan (ERP) Document Number: 1440-85-OP-PR-0005
- GoM Safe Practices Manual (SPM) – GoM Incident Notification, Reporting and Investigation Procedure. Document Number: CD # UPS-US-SW-GOM-HSE-DOC-00115-2
- GoM IMS Vol II – Regional Oil Spill Plan
- GoM IMS Vol III – Severe Weather Contingency Plan
- GoM Contract Aircraft Guidelines
- GoM Diving Procedures
- GoM Operational Guidelines for Offshore Support Vessels
- GoM DEN Operations Manual
- 500-m Zone Practice – BP Marine
- VOI – Vessel Operating Instructions – BP Marine
- Fan Beam User Manual v. 4.1
- DMAC (Diving Medical Advisory Council) dated 1979

Appendix A: Contact Details – MC-252 Incident

Name	Telephone	E-Mail	Title
Emergencies and Regulatory			
Terrebonne General Medical Center 8166 Main Str. Houma	(985) 873-4141 Oper. (985) 873-4150 Emerg.		
US Coast Guard	(504) 589-6225 (985) 380-5320		
Houston Crisis Center **BP ICP – 24 Hour Number**	**(281) 366-0286 O** **(713) 208-6173 C** **(800) 321-8642** **(630) 961-6200**		
MMS Houma District MMS Pipeline Section	(985) 853-5884 O (985) 879-2738 F (985) 688-6050 C (504) 736-2814 O (504) 736-2408 F (504) 452-3562 C		
Douglas, Scherie	(281) 366-6843 O (713) 702-7673 C	Scherie.douglas@bp.com	Sr. Regulatory & Advocacy Advisor
SIMOPS Director			
Endicott, troy	(281) 366-7687 O (713) 409-0061 C	Troy.endicott@bp.com	Deputy Marine Authority
Oil Spill Response Command			
Smith, Stephen (O'Brian Group)	(866) 215-4586 (866) 292-1326	mops.lar.master@msrc.org smiths3663@hotmail.com	Oil Spill Response On-Scene SIMOPS Coordinator (onboard Louisiana Responder 866-292-1326)
Source Control Vessel Command			
Sepulvado, Murry	(318) 471-1763	sepulvmr@bp.com	Source Control
TOI Discoverer Enterprise			
Captain OIM Bridge / DPO Radio room BP WSL BP Clerk / dispatch BP Subsea	(832)-587-5530/5 (713) 587-5531 713-232-8245 ext. 2008 or 2007 (713) 232-8245 (281) 366-4504 or (281) 366-4506 (281) 366-4515 (281) 366-4536	captain.den@deepwater.com Oim.den@deepwater.com dpoperator.den@deepwater.com Sat Telephone Bridge (voice): 0-11-870-353-830-551 Sat Telephone Radio Room (voice): 0-11-870-353-830-550 Iridium Sat Phone: 1-480-768-2500 code 8815-4147-9794 Radio Frequency Ch 12 VHF (MHz) - 156.650	

Name	Telephone	E-Mail	Title
Port and Stb. ROV	(713) 232-8245 ext. 2229	Radio Frequency Ch 16 VHF (MHz) - 156.800 Helicopter VHF (MHz) – 123.050 Call Sign V7HD3	
TOI Development Driller III			
DD III Well Site Leader (Craig Wright, Earnest Tate, Wayne Purvis, Dwight Nunley, Tim Speirs) Radio Rm. DD III Inmar Sat DPO Captain BP Dispatcher	**713-336-8218** 832-587-6871 Dial 0 for operator 011 870 764449920 x-203 and x-204 x-206 713-336-8215 713-336-8229 713-336-8201	dd3wellsiteleader@bp.com dpoperator.dd3@deepwater.com mil80@oceaneering.com Mil14@oceaneering.com	
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Gray, George	(281) 366-0659 O (713) 376-1099 C	George.gray@bp.com	DD III Team Leader
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TOI Rig Support			
Brekke, Jim	(281) 925-6676 O (281) 961-1368 C	jim.brekke@deepwater.com	Manager Marine Technology
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Richards, Ramsey	(281) 925-6433 O (713) 205-9474 M (713) 782-4703 H	ramsey.richards@TOIdrill.com	TOI DD III Rig Manager
Sims, Chuck	(281) 925-6581 O (281) 925-6583 F (832) 922-2633 C	chuck.sims@TOIdrill.com	Manager DP and Instrumentation
Walker, Stephen	(832) 587-8770 O (281) 450-7266 C	Steven.Walker@deepwater.com	Marine and DP Superintendent NAM
Logistics Boats and Helicopters Houston			
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Name	Telephone	E-Mail	Title
	(281) 366-7946 F (281) 703-0203 C		Coordinator
John Rougeau	(281)-366-5042 O (713)-201-3081 C	John.rougeau@bp.com	Deepwater Marine Coordinator
Reeves, Harold J.	(281)-366-4323 O (713)-907-3739 C	Harold.Reeves@bp.com	Subsea Ops & Intervention Leader
Verret, Brian	(337) 735-5441 O (337) 578-2425 C	Brian.verret@bp.com	Aviation Coordinator
Russell, Virgil	(281) 366-0571 O (281) 382- 3719 C	virgil.russell@bp.com	Aviation Team Lead
Huston, John	(281) 366-5795 O (713) 962-5927 C	John.huston@bp.com	GoM Logistics and Materials Management Manager
Fourchon Base			
Base Supervisor Deepwater Dispatcher	(337) 735-5708 O (337) 735-5701 O (985)-396-2927 C	supvisfb@bp.com dispchfb@bp.com	
Dartez, Bradley	337-735-5726 O (281) 705-2372 C	Bradley.dartez@bp.com	Logistics Coordinator
Deepwater Receiving Shipping	(337) 735-5702 O (337) 735-5715 O (337)-735-5703 O	Mailing address Fourchon Base: Fourchon Base Address: BP / C-Port 1 106 9th st. Lot #1 Golden Meadow, La. 70357 PH # 337-735-5708	
Shore base manager	337-735-5714 O 985-396-2467 C		
Marine Dispatcher Production	337-735-5712 O		
Air Logistics	337-365-6771		
PHI (Houma)	985 868 1705	Mailing Address: PHI Heliport 3622 Thunderbird Rd Houma, LA 70363 Ph.: (337) 735-5351	
BP Marine			
Fuller, Dan	(281) 366-6313 O (713) 397-4343 C	Dan.fuller@bp.com	Marine Operations Lead
Nichols, Scott	(281) 366-4815 O (713) 826-3426 C	scott.nichols@bp.com	Marine Operations Superintendent
Polk, Daniel	(281) 366-0538 (713) 825-2657	Daniel.polk@bp.com	Marine Operations Lead

Name	Telephone	E-Mail	Title
Vessels			
Source Control Vessels			
Ocean Intervention - 3	713-744-5929 713-744-5920	captain@intervention.islandoffshore.com	
BOA Sub C	832-461-8266 Client Office 832-461-8269 owner office	captain@boasubc.no	
Boa Deep C	203-575-5434 client office 203-575-5431 owner office 203-575-5437 Bridge	offshore-supervisorbdc@boa.no	
C-Express	985-612-2301 Bridge 985-612-2304 ROV	mv.c-express@chouest.com	
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Nikola	225-289-6112	nikola@teslaoffshore.com	
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Spill Cleanup Vessels			
Joe Griffin	985-612-2417	mv.joe.griffin@chouest.com	
C-Captain	254-543-7829 985-612-2346	mv.c-captain@chouest.com	
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C-Enforcer	254-240-1951 985-612-2341	mv.c-enforcer@chouest.com	
C-Carrier	011-881-651-436535	mv.c-carrier@chouest.com	

Name	Telephone	E-Mail	Title
	985-612-2330		
C-Fighter	985-612-2319	mv.c-fighter@chouest.com	
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C-Express	Bridge 985-612-2301 ROV 985-612-2304	mv.c-express@chouest.com	
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C-Legacy	254-204-3130 985-612-2355	mv.c-legacy@chouest.com	
Fast Cajun	011-881-651-423025 985-612-2357	mv.fast.cajun@chouest.com	
Fast Sailor	985-612-2359	mv.fast.sailor@chouest.com	
Pat Tillman	985-612-2409	pattillman@tdwboats.com	
Damon Bankston	985-612-2406		
Gulf Princess	985-612-2407		
Sailfish	985-612-2408		
CapRock			
CapRock Champagne, Ken	337-593-5514	kchampaigne@caprock.com	Telephone system Edison Chouest
C&C Technologies Surveying			
C&C Technologies George L. Buhler	(713) 468-1536 O (281) 914-9629 C	George.buhler@cctechnol.com George.buhler@sbcglobal.net	Survey advisor
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Updated April 28, 2010			

NMFS Activities in Support of DEEPWATER HORIZON Oil Spill Response
April 26, 2010

Last night we had a conference call between NMFS and NOS/OR&R to coordinate NMFS subject matter experts advising through OR&R to USCG for impacts due to large scale dispersant application operations. Participants included;

Gary Shigenaka OR&R Seattle
Ed Levine OR&R On Scene

Michael Gallagher NMFS HQ
Bonnie Ponwith NMFS Southeast Fisheries Science Center Director
Theo Brainerd NMFS Southeast Fisheries Science Center Deputy
Lance Garrison NMFS SEFSC, Miami
Sheryan Epperly NMFS SEFSC, Miami
Keith Mullin NMFS SEFSC, Pascagoula Lab
Teri Rowles NMFS HQ, Office of Protected Resources
Bob Hoffman NMFS Southeast Region, St. Pete

NMFS Southeast Fisheries Science Center is rounding up their qualified marine mammal spotters with current aircraft safety credentials to man the spotter aircraft that accompany the dispersant application operations. The spotters will advise on the presence of marine mammals and turtles while actively spraying dispersant. NMFS spotters should be flying by late today or Tuesday.

Bonnie Ponwith suggested that NMFS archival marine mammal surveys for the affected area at this time of year are not adequate to accurately assess numbers and species being impacted by the spill. She recommends that we perform a 2 – 3 day synoptic aerial survey of the affected area. NMFS personnel are presently drafting flightlines for such a survey. NOAA's Aircraft Operations Center (AOC) has been contacted about availability of a twin otter aircraft for the effort. If AOC cannot provide a suitable aircraft in the next few days, NMFS will seek a charter aircraft with funding through the responsible party.

Teri Rowles is coordinating efforts of the NMFS Gulf Marine Mammal Stranding Network with the work of the Unified Command's Wildlife Branch to be sure affected animals receive proper care and are accounted for NRDA purposes.

Since this appears to likely be a long – term response which may involve fishery closures next to areas with open fisheries, NMFS Office of Seafood Inspection will be reaching out to states and local seafood processors to make sure the scope of their inspection services are understood and utilized as needed.

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Oil dispersant increases PAH uptake by fish exposed to crude oil

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Abstract

The use of oil dispersants is a controversial countermeasure in the effort to minimize the impact of oil spills. The risk of ecological effects will depend on whether oil dispersion increases or decreases the exposure of aquatic species to the toxic components of oil. To evaluate whether fish would be exposed to more polycyclic aromatic hydrocarbon (PAH) in dispersed oil relative to equivalent amounts of the water-accommodated fraction (WAF), measurements were made of CYP1A induction in trout exposed to the dispersant (Corexit 9500), WAFs, and the chemically enhanced WAF (dispersant; CEWAF) of three crude oils. The crude oils comprised the higher viscosity Mesa and Terra Nova and the less viscous Scotian Light. Total petroleum hydrocarbon and PAH concentrations in the test media were determined to relate the observed CYP1A induction in trout to dissolved fractions of the crude oil. CYP1A induction was 6- to 1100-fold higher in CEWAF treatments than in WAF treatments, with Terra Nova having the greatest increase, followed by Mesa and Scotian Light. Mesa had the highest induction potential with the lowest EC_{50} values for both WAF and CEWAF. The dispersant Corexit was not an inducer and it did not appear to affect the permeability of the gill surface to known inducers such as β-napthoflavone. These experiments suggest that the use of oil dispersants will increase the exposure of fish to hydrocarbons in crude oil.

Keywords: Crude oils; Dispersant Corexit EC9500; CYP1A; EROD activity; Water-accommodated fraction

1. Introduction

Dispersants have been in use in oil spill clean-up since the 1950s. Chemical dispersion of oil in spill contingency exercises was not favored due to the toxicity of the early dispersant formulations to aquatic organisms. Laboratory studies of their observed toxicity (Linden, 1974; Hartwick et al., 1982; Carr and Linden, 1984) were further validated by field reports (Smith, 1968) from the Torrey Canyon and more recently the Sea Empress oil spills for which dispersants were used (Lewis and Aurand, 1997). However, many effective and less toxic dispersants have since been developed.

Risks to aquatic organisms from chemical dispersion could arise from exposure to the dispersant as well as to the dispersed oil. Much research has been conducted on the toxicity of dispersants (Nelson-Smith, 1977; Singer et al., 1993; Law, 1995; Carr and Linden, 1984; Cotou et al., 2001), but in general less is known about the combined effects of oil and dispersants (Linden, 1975; Cohen et al., 2001; Gagnon and Holdway, 2000). Aquatic organisms are unlikely to be exposed to dispersant alone but instead to both dispersant and oil in combination, which may either exacerbate or mitigate toxic effects (Getter and Baca, 1984).

Dispersants are essentially surfactants comprising anionic and nonionic molecules in fixed ratios that render both hydrophilic and hydrophobic properties to the dispersant. Their purpose is to orient at the oil–water interface and lower interfacial tension, thus facilitating the formation of small (<100 μm) mixed oil–surfactant micelles (Canevari, 1978). These oil emulsion droplets are driven into the water column forming a plume, thus breaking up the slick. The observed increased toxicity of dispersed (chemically or mechanically) oil has been attributed to particle size in dispersion (Bobra et al., 1989) and to aromatic hydrocarbon content (Anderson et al., 1974). The primary route of hydrocarbon uptake is via the gills

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(Thomas and Rice, 1981); thus, the dissolved fraction would be the most available form to animals.

The majority of studies of the toxicity of oil and oil–dispersant treatments concerns their impacts on invertebrate species, presumably because they are relatively sessile compared to fish. However, recent studies of the impacts of oil from the Exxon Valdez spill on embryonic and larval stages of salmon and herring demonstrated both exposure and chronic toxicity in situ. The coincidence of spawning and oil deposition in spawning shoals resulted in CYP1A induction, blue sac disease of larvae, and recruitment failure, and effects were associated with exposure to the polycyclic aromatic hydrocarbon (PAH) fractions (Carls et al., 1999). The risk to fish from oil and oil–dispersant treatments can be assessed in terms of exposure to PAH, and changes in exposure after the use of dispersants. PAH exposure can be estimated by a standardized laboratory bioassay of CYP1A induction in juvenile rainbow trout, *Oncorhynchus mykiss* (Hodson et al., 1996).

Dispersant effectiveness is usually influenced by a number of factors, which include sea energy, temperature, salinity, and the nature of the crude oil itself. Crude oils are a complex matrix of organic compounds, which, upon spilling, evaporate or dissolve and disperse into the water column. Light oils are known to have a higher proportion of volatile aromatics, some of which dissolve more readily (Volkmann et al., 1994). Dispersant effectiveness on these oils is less noticeable than in medium and heavy crude oils that comprise a higher proportion of longer and branched carbon chains with reduced solubility.

The objective of this study was to determine the effects of the dispersant Corexit 9500 on the exposure and toxicity to fish of hydrocarbons from three kinds of crude oil of varying viscosities. Fish were exposed to the water-accommodated fraction (WAF) and chemically enhanced (dispersed) WAF (CEWAF) of the oils. The hepatic CYP1A activity in juvenile rainbow trout exposed to WAF and CEWAF was used to measure the changes in exposure to dissolved and dispersed PAH created by the use of dispersant. Lethality was used as an index of toxicity. Total petroleum hydrocarbon (TPH) and PAH concentrations in the test solutions were also measured as an index of actual exposure concentrations.

2. Materials and methods

2.1. Experimental design

Tests (48 h) were conducted to assess the effects of Corexit on the extent of hydrocarbon uptake, which was indicated by CYP1A induction in fish exposed to mixtures of WAF and CEWAF. Test conditions were determined by preliminary assays to evaluate the lethality and CYP1A induction potential of Corexit alone, and the duration of the tests required to produce maximal CYP1A activity.

2.2. Crude oil and dispersant

Three kinds of weathered crude oil of varying viscosities were tested (1) Mesa sour crude (viscosity of 42.3 cP), (2) Terra Nova crude (viscosity of 50.1 cP), and (3) Scotian Light crude (viscosity of 3.76 cP) at 21°C. Mesa oil was weathered by evaporation (sparging with air for 130 h) to simulate the loss (approximately 14%) of volatile components at sea shortly after a spill (Hodson et al., 2002). The Terra Nova and Scotian Light crude oils were not weathered. Dispersant-type Corexit EC9500 was used for dispersing the oils. Corexit 9500 is a hydrocarbon-based reformulation of water-based Corexit 9527 and is meant to be used on higher viscosity oils and emulsions. The acute aquatic toxicity of Corexit 9500 was reported to be not much different from that of Corexit 9527and Corexit 9554 (Singer et al., 1996).

2.3. Fish stock

Juvenile rainbow trout (8–10 weeks of age) were obtained from a trout farm (Rainbow Springs, Thamesford, ON, Canada) and acclimatized for at least 1 week in dechlorinated water (12–15°C) prior to the bioassays. During acclimation, the trout were fed daily with a commercial fish food (Martins Feed Mills, ON, Canada) daily at a rate of 3% body weight per day. Feed was withheld 48 h prior to bioassay and throughout the exposure period.

2.4. Exposure experiments

2.4.1. Preparation of WAF and CEWAF

The WAF was prepared fresh daily by the stirring of crude oil with dechlorinated municipal water at a ratio of 1:9 in sealed containers with minimum head space for 18 h at 18°C. The vortex was adjusted to no more than a third of the height of the mixture from the oil–water interface (Singer et al., 2000). This particular ratio of oil to water has been reported as the optimum to maximize the TPH content of the water column (Gagnon and Holdway, 2000). The mixture was allowed to settle for 1 h for the separation of the water and oil phases, and the water phase was drained off for testing via a tap at the bottom of the tank.

CEWAF was made by mixing oil and water in the same ratio as that for WAF and by stirring for the same duration. The dispersant Corexit 9500 was added with a Pasteur pipette to the surface of the oil–water mixture at the recommended ratio of 1:20 dispersant:oil (Gilbert,

1996) and allowed to stir for an additional hour. The resulting solution contained droplets of dispersed oil, and was allowed to settle for another hour before the cloudy emulsion layer at the bottom was drained.

2.4.2. Exposure group

For each oil treatment, groups of five fish were exposed to a series of WAF and CEWAF concentrations in 10 L of water. Waterborne β-napthoflavone (10 μg/L in 10 L), a known CYP1A inducer, served as a positive control while Corexit EC9500, mineral oil, and dechlorinated municipal water were used as negative controls. All solutions were renewed every 24 h.

Exposure concentrations causing CYP1A induction and lethality were determined from range-finder tests. Solution concentrations ranged from 0.0001 to 0.56% of WAF or CEWAF (v/v) for Mesa, 0.0001–0.10% of WAF or CEWAF (v/v) for Terra Nova; and 0.001–1.0% of WAF or CEWAF (v/v) for Scotian Light. The exposure duration was fixed at 48 h because preliminary tests showed that 48 and 96 h of exposure caused comparable CYP1A induction. At the end of each 48 h test, exposed fish were sacrificed and their livers removed for the CYP1A assay. Physicochemical factors (temperature, pH, dissolved oxygen, and conductivity) were measured daily in each experiment. The concentration of ammonia was measured at the end of each test. Test conditions are presented in Table 1.

2.5. EROD assay

CYP1A activity (ethoxyresorufin-*o*-deethylase, or EROD, activity) was assessed by a fluorometric method that measures the rate of deethylation of ethoxyresorufin (Hodson et al., 1996, modified by Fragoso et al., 1998). Livers were homogenized in HEPES/KCl buffer at pH 7.4 and centrifuged at 9000*g* for 20 min at 4°C to isolate the microsomes (S9 fraction), which were quick-frozen in liquid nitrogen and stored at −86°C until assayed. The rate of resorufin production was measured using a microplate spectrofluorometer at excitation and emission wavelengths of 530 and 586 nm, respectively. The values were normalized against crude protein concentrations assayed by the Bio-Rad Protein Kit and measured on a microplate spectrophotometer at 600 nm. All assays were performed in triplicate. EROD activity was expressed as picomoles of resorufin produced per minute per milligram protein in the S9 fraction (pmol/min/mg Pr). EROD values were normalized to water controls. The mineral oil exposures provided a baseline induction.

2.6. Analysis of hydrocarbons

Water samples of 250 and 300 mL were taken during the daily renewal for TPH and PAH analysis, respectively. Samples for PAH extraction were spiked with 1.0 mL of surrogate standard comprising nine PAHs prior to solvent extraction. Samples for TPH analysis were extracted in three 50-mL lots of hexane, while those for PAH were extracted in three 20-mL lots of AR-grade dichloromethane and dried by filtration through sodium sulfate. The extract was concentrated by roto-evaporation and further reduced to 1.0 mL by drying with compressed nitrogen. TPHs were analyzed by gas chromatography, and concentrations in three boiling point fractions, C10–C16, C 16–C34, and C34–C50, were calculated from calibration curves derived for the C10, C16, and C34 hydrocarbons. The analytical method used was an adaptation of a Canadian Council of Ministers of the Environment Tier 1 Method (CCME, 2000).

Dichloromethane extracts for PAH analysis were sent to the Centre for Offshore Oil and Gas Environmental Research (COOGER–CREPGE), Bedford Institute of Oceanography (Nova Scotia, Canada), for analysis by gas chromatography/mass spectrometry (Garcia-Blanco et al., 2001).

2.7. Statistical analysis and LC_{50} calculations

Statistical analyses were performed using SigmaStat software. For each oil, EROD activity values were log transformed to achieve a normal distribution, as demonstrated by the Kolmogorov–Smirnov normality test and the Levene median equal variance test. One-way analysis of variance with treatment as a factor was applied to detect differences among treatments (control, WAF, and CEWAF). The *post hoc* Bonferroni multiple comparison test was used to identify treatment concentrations that were significantly different from each another. Median effects concentrations (EC_{50} as percentage of maximum EROD activity) for the WAF and CEWAF exposures of each oil were calculated from induction curves using Graph Pad–Prism software to fit a linear regression.

Table 1
Test conditions for juvenile trout 48-h static bioassays with daily renewal

Fish weight (g)	pH	Temperature (°C)	Conductivity (μS/cm)	Dissolved oxygen (% saturated)	Total ammonia (ppm)
2.62 ± 1.34	7.98 ± 0.31	13.7 ± 1.2	265 ± 41	94.6 ± 13.7	0.55 ± 0.18

$n = 2$ days × three oils × 14 buckets; mean ± SD.

3. Results

3.1. Toxicity of Corexit EC9500, WAF, and CEWAF

The 96-h LC_{50} of Corexit EC9500 was estimated to be between 100 and 1000 mg/L. There was no increase in EROD activity at dispersant concentrations ranging from 1.0 to 10,000 mg/L even though there was lethality at the higher concentrations. In terms of toxicity, Scotian Light was the most toxic, as 1% (v/v) CEWAF was lethal. CEWAF treatments for both Mesa and Terra Nova were lethal at 10% (v/v). There was no mortality in all WAF treatments up to 100% (v/v).

3.2. EROD activity in fish exposed to WAF and CEWAF

EROD activity in trout exposed to all three crude oils increased in response to CEWAF exposure at concentrations of 0.0001 (v/v) to 0.32% (v/v) (Fig. 1). Scotian Light concentrations above 0.32% were lethal. Fish in both WAF and CEWAF treatments showed up to a 60-fold higher EROD activity than fish exposed to mineral oil and water controls ($P<0.05$, Bonferroni pair-wise comparison). In both the WAF and CEWAF treatments for all three oils, EROD activity increased in response to increasing exposure concentrations up to 0.1% (v/v). Further increases in concentration (>0.1%) for CEWAF treatments resulted in decreased activity.

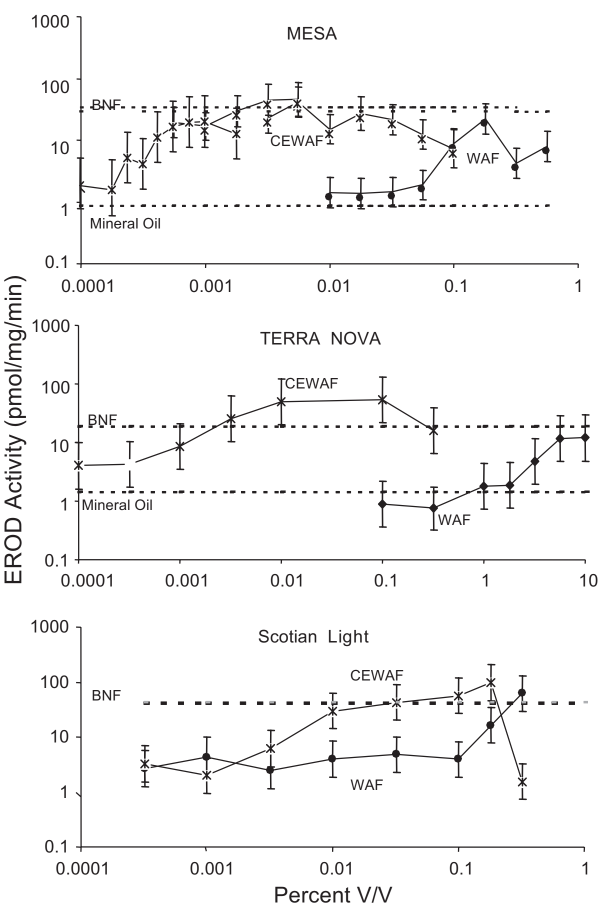

Fig. 1. EROD activity (pmol/min/mg protein) in trout exposed to a range of WAF or CEWAF concentrations from crude oils or to one concentration of mineral oil or 10 µg/L β-napthoflavone (BNF). Error bars, 95% confidence limits.

The exposure–response curve for Mesa crude oil was derived from three separate tests, with the second and third added at successively lower exposure concentrations to define the EC_{50}, as indicated in Fig. 1. There was very good concordance in EROD activity for overlapping concentrations among the three tests.

The consistent shift of the CEWAF induction curves to the left of that of WAF for Mesa and Terra Nova reflects exposure to higher hydrocarbon concentrations for CEWAF concentrations for a given percentage v/v. In the case of Scotian Light, the curves overlapped, but EROD activity values were significantly higher for CEWAF treatments than for WAF treatments.

EC_{50} values (Table 2) for both WAF and CEWAF of the three oils showed the following rank order of induction potency: Mesa CEWAF > Terra Nova CEWAF > Scotian Light CEWAF > Mesa WAF > Scotian Light WAF > Terra Nova WAF. PAH concentrations (estimated from the PAH data in Table 3) corresponding to the EC_{50} were between 0.60 and 2.00 µg/L for both treatments from all three oils. The difference in induction potential calculated from the ratio of EC_{50} WAF: EC_{50} CEWAF was greatest for Terra Nova (1090×), followed by Mesa (110×) and Scotian Light (6×). Scotian Light was more easily dissolved and dispersed than the other two oils and was also the most toxic (0.32% v/v CEWAF; Fig. 1).

3.3. Polycyclic aromatic hydrocarbons

The PAHs shown in Table 3 were detectable in WAF or CEWAF of Mesa, Terra Nova, and Scotian Light. However, only three, methylfluorene, dimethyldibenzothiophene, and methylphenanthrene, were common and detectable among most of the exposure solutions. More PAH compounds were detected in the higher CEWAF concentrations, such as 0.32 and 0.56% (v/v) of Mesa and Scotian Light crude oils, but the concentrations were all below 2.5 µg/L (Table 3; instrument detection limit of 50 ng/L).

PAH measurements of both WAF and CEWAF test solutions for the three kinds of oil are shown in Fig. 2. Increasing concentrations of some PAHs (methylphenanthrene, dimethyldibenzothiophene, and methylfluorene) were observed at the higher concentrations (0.032, 0.056, and 0.10%) (v/v) in CEWAF from Mesa crude oil. Concentrations of methylphenanthrene were 2–4 times higher in CEWAF compared to WAF, while dimethyldibenzothiophene was 5–10 times higher.

Table 2
EC_{50} values for CYP1A induction (EROD activity) in trout exposed to WAF or CEWAF of three oils

Types of crude oil	EC_{50} WAF		EC_{50} CEWAF		Induction potential
	% (v/v)	PAH concentration	% (v/v)	PAH concentration	$\frac{EC_{50}\ \text{WAF}}{EC_{50}\ \text{CEWAF}}$
Terra Nova	3.350	1.80	0.003	1.50	1116
Mesa	0.106	0.72	0.001	0.60	106
Scotian Light	0.390	1.56	0.066	2.00	5.91

EC_{50} values were calculated from a Graph–Pad Prism using percentage EROD activity values (maximum EROD activity of 100%). PAH concentrations (μg/L) were the sum of estimated PAH concentrations (see Table 3) corresponding to the EC_{50}s for WAF or CEWAF (% v/v).

In Terra Nova crude oil exposures, concentrations of acenapthylene increased in CEWAF and WAF treatments of 0.1% and 1.0% (v/v), respectively, with concentrations in CEWAF being double those of WAF at 0.1% (v/v). The concentrations of other detected PAHs in CEWAF treatments of <0.1% were equal to those in the more concentrated WAF treatments (Fig. 2). For Scotian Light, the concentrations for dimethyldibenzothiophene were 10 times higher in the CEWAF than in the WAF treatments. The PAHs that were most concentrated in oil were most concentrated in CEWAF.

3.4. Total petroleum hydrocarbons

Concentrations of TPH for the less concentrated CEWAF and for all WAF treatments were below a detection limit of 10 μg/L. Scotian Light CEWAF treatments of 0.18, 0.32, and 0.56 (v/v) had TPH concentrations of 30, 83, and 266 μg/L, respectively, while Terra Nova CEWAF mixtures of 0.10% and 0.32% (v/v) had TPH concentrations of 34 and 53 μg/L TPH.

4. Discussion

4.1. EROD activity in fish exposed to WAF and CEWAF

EROD activity was a reliable and repeatable measure of exposure to hydrocarbons from crude oil. The exposure response curves for all three oils clearly denoted a greater EROD response to CEWAF than to WAF. PAHs responsible for CYP1A induction were presumably at higher concentrations in CEWAF treatments than in WAF treatments. CYP1A induction was observed at very low concentrations of dispersed oil (as little as 0.0001% (v/v)), up to 1100× less than in nondispersed oil, suggesting that fish exposed to dispersed oil are at greater risk of hydrocarbon toxicity. Similar observations of higher EROD activity in fish exposed to CEWAF versus WAF have been reported (Gagnon and Holdway, 2000; Cohen et al., 2001).

EROD activity decreased at the highest concentrations of CEWAF for all three oils, presumably arising from liver damage (Gagnon and Holdway, 2000). The EC_{50} values confirmed the higher induction potential of CEWAF compared to WAF. Mesa oil had the lowest EC_{50} for both WAF and CEWAF, suggesting the presence of either high-potency CYP1A inducers or inducers at higher concentrations. This was further apparent in the higher number of PAHs detected in Mesa oil and the correspondingly higher total PAH concentration.

The ratio of WAF EC_{50} to CEWAF EC_{50} (for each oil) indicates the extent of dissolution of PAH with dispersion. Terra Nova, being the most viscous, had the highest ratio, followed by Mesa and Scotian Light. Thus, Corexit 9500 seems effective for its intended use on higher viscosity oils.

PAH concentrations at the EC_{50} estimated for all three oils show comparable values for WAF and CEWAF over a narrow range (Table 2), thus lending weight to the reliability and accuracy of EC_{50} values. The finding is consistent with the assumption that PAHs are primarily responsible for CYP1A induction in fish. Mesa had the lowest EC_{50} (i.e., greatest toxicity), confirming the presence of strong inducers.

There were no confounding factors from hydrocarbons present in Corexit EC9500, as it caused no discernable increase in the EROD activity of exposed trout. There was, however, some toxic response at higher concentrations. LC_{50} values for Corexit EC9500 were similar to reported LC_{50} values for Corexit 9527 (Gagnon and Holdway, 2000).

EROD activity in the negative controls (water and mineral oil) was minimal and equivalent to background levels previously observed for trout (Fragoso et al., 1998). Corexit EC9500 had no effect on the permeability of gill surfaces, because EROD activity did not increase when fish were exposed to β-napthoflavone in the presence of varying concentrations of dispersant (data not reported). The robustness of the EROD assay for measuring exposure was further illustrated by the tight overlap of three separate induction curves derived from three tests of Mesa crude oil (Fig. 1).

Table 3
PAH concentrations (μg/L) detected in WAF and CEWAF treatments for three crude oils

Mesa WAF % (v/v)			0.010	0.018	0.032	0.056	0.100	0.18	0.32	0.56	
Methylfluorene			0.13	0.28	0.16	0.03	0.24		0.18	0.02	
Dimethyldibenzothiophene			bdl	bdl	bdl	bdl	bdl		bdl	bdl	
Trimethyldibenzothiophene				0.18							
Methylphenanthrene			0.47	0.51	0.38	0.38	0.48		0.43	0.42	
Mesa CEWAF % (v/v)	0.0032	0.0056	0.010	0.018	0.032	0.056	0.100				
Fluorene											
Methylfluorene	0.18		0.13	0.29		0.37	0.66				
Dibenzothiophene							0.33				
Methyldibenzothiophene						0.87	1.45				
Dimethyldibenzothiophene	bdl	bdl	bdl	0.15		0.55	1.06				
Trimethyldibenzothiophene				0.26		1.13	1.39				
Tetramethyldibenzothiophene						0.74	1.10				
Phenanthrene							0.54				
Methylphenanthrene	0.43		0.46	0.45		1.07	1.89				
Dimethylphenanthrene						1.35	2.31				
Trimethylphenanthrene						1.29	1.95				
Tetramethylphenanthrene						0.55	0.74				
Methylpyrene							0.30				
Trimethylpyrene						0.29	0.42				
Tetramethylpyrene						0.23	0.36				
Dimethylpyrene						0.33	0.44				
Methylnapthobenzothiophene						0.28	0.39				
Dimethylnapthobenzothiophene						0.67	1.02				
Dimethylchrysene						0.29	0.39				
Trimethylchrysene							0.29				
Scotian Light WAF % (v/v)		0.0032	0.01	0.032	0.10		0.32		1.0		
Acenaphthylene		1.65	1.72	1.76	1.37		1.40		1.56		
Methylfluorene		bdl*	0.008	0.04	0.056		0.07		bdl		
Methyldibenzothiphene									0.30		
Dimethyldibenzothiphene		0.02	bdl	0.04	0.03		0.09		0.05		
Scotian Light CEWAF %(v/v)	0.001	0.0032	0.010		0.10	0.18	0.32	0.56			
Naphthalene							0.20				
Dimethylnaphthalene							0.29				
Trimethylnaphthalene							0.41				
Tetramethylnaphthalene							1.14				
Acenaphthylene	1.68	1.69	1.57		1.80	1.92	2.02	1.77			
Methylfluorene	bdl	bdl	0.19		0.07	bdl	0.30	0.03			
Methyldibenzothiphene						0.23	0.98				
Dimethyldibenzothiophene	bdl	bdl	0.36		0.13	0.30	0.87	0.17			
Anthracene			0.29				0.18				
Dimethylphenanthrene							0.41				
Trimethylphenanthrene						0.31	0.43				
Methylpyrene							0.19				
Dimethylpyrene							0.17				
Terra Nova WAF % (v/v)						0.10	0.32	1.0	1.8	5.6	10.0
Acenaphthylene						1.06	1.35	1.47	1.63	1.42	1.58
Methylfluorene						0.09	0.14	0.05	bdl	0.02	0.06
Dimethyldibenzothiophene						0.13	0.17	0.07	0.06	0.10	0.05
Trimethyldibenzothiophene						0.056	0.076	0.17	0.17	0.18	0.17
Methylphenanthrene						0.14	0.21	0.04	0.02	0.10	0.12
Terra Nova CEWAF % (v/v)	0.0001	0.0003	0.0010	0.0032	0.01	0.10	0.32				
Acenaphthylene		0.98		1.48	1.39	2.21	1.68				
Methylfluorene		0.06		bdl	0.04	0.09	0.04				
Dimethyldibenzothiophene	bdl	0.12		0.02	0.09	0.30	0.22				
Trimethyldibenzothiophene		0.18				0.18	0.15				
Methylphenanthrene	bdl	0.08		bdl	0.07	0.16	0.42				
Dimethylphenanthrene							0.39				
Trimethylphenanthrene							0.22				

bdl, below detection limit.

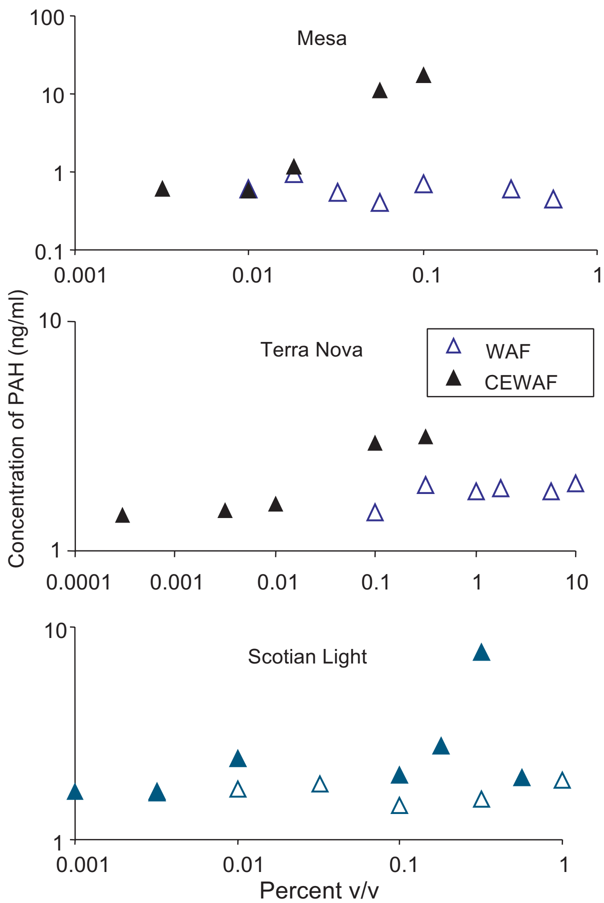

Fig. 2. Sum of polycyclic hydrocarbon concentrations detected in the WAF and CEWAF test solutions.

4.2. Polycyclic aromatic hydrocarbons

Dispersing oil markedly increased hydrocarbon concentrations in test solutions based on measured concentrations of PAH. More napthalenes were detected in CEWAF than in WAF from Mesa crude oil. Fucik (1994) found hydrocarbon concentrations in dispersed Central Gulf oil four to five times higher than WAF with napthalenes as the dominant fraction. Cohen and Nugegoda (2000) also reported that dispersed oil WAF (CEWAF) had the highest concentration of TPHs compared to crude oil WAF. The increase in hydrocarbons could be due to the presence of oil droplets in emulsion or increased dissolution of hydrocarbons from the surfaces of the numerous droplets (surface area effects). One must realized that in WAF, hydrocarbon concentrations are determined by the solubilities of the various compounds. Conversely, CEWAF concentrations are primarily influenced by the presence of bulk oil droplets. This is largely due to the emulsifying action of the dispersant that drives the oil–surfactant micelles into solution. Therefore, the amount of PAH in solution is determined by the solubility of each compound, the rate of partitioning into solution across the oil–water interface, and the size of the surface area available for partitioning, as determined by droplet size.

4.3. Total petroleum hydrocarbon

For TPH, most of the concentrations were below detection limits (3 μg/L). The more concentrated solutions of CEWAF from Scotian Light crude oil (0.32 and 0.56% v/v) had TPH concentrations of 60 and 266 μg/L, respectively, which are comparable to observations of 200 μg/L for the 0.5% (v/v) CEWAF of Bass Strait Crude Oil (Cohen et al., 2001).

Most TPH concentrations were above the detection limit, but because of higher blank values, they were not quantified. Despite this, an exposure–response relationship of EROD activity with hydrocarbon concentration was observed for C16 in WAF of Terra Nova and C10 and C16 in CEWAF of Scotian Light. A correlation coefficient (Pearson r value) of 0.952 was calculated between EROD activity and the C10 TPH fraction of the CEWAF treatment of Scotian Light crude. Dispersant effectiveness is a major controlling factor in the bioavailability of hydrocarbons. The higher ratio of hydrocarbons in CEWAF versus WAF for Scotian Light compared to Terra Nova is an indication that lighter oils would disperse more effectively as bulk oil droplets than heavier ones (Fingas, 1995). However, the EROD response of fish in this experiment suggests that Corexit EC9500 solubilizes PAH more effectively from heavier oils than from light oils.

While the preparation of WAF and CEWAF was carried out as prescribed in the literature, there may have been some conditions that were overlooked. Factors relevant to this study include the manner and order in which the dispersant was added. When dispersant was added to the oil layer surface and then vortexed, the likelihood of sufficient dispersant contact was reduced; oil can be stranded on the vessel walls because of herding at initial dispersion (Singer et al., 2000). This would have been especially significant in the case of the less viscous Scotian Light. A second factor of relevance is the preparation of the test concentrations. Test treatments should be derived from a range of oil loadings and not serial dilutions, because partitioning of compounds into the aqueous phase is not directly correlated to the oil:water ratio (Girling et al., 1994).

The following conclusions can be drawn from this study. Dispersing crude oil increased the bioavailability of PAHs to fish, as reflected by greater CYP1A induction in the livers of fish exposed to CEWAF versus WAF treatments. Second, the action of the dispersant was influenced by the viscosity of the crude oils. Terra Nova, which had the highest viscosity value, had the biggest difference in induction for CEWAF and

WAF treatments. Scotian Light had the lowest viscosity value and showed the smallest difference in induction values, while Mesa was intermediate.

While it was difficult to detect most of the PAHs and petroleum hydrocarbons at the lower doses of WAF and CEWAF by sensitive analytical techniques such as gas chromatography/mass spectrometry, the EROD assay proved to be much more reliable and sensitive for detecting effects at low concentrations ($<0.0032\%$ v/v).

In an ecological context, this study revealed an increase in exposure of fish to hydrocarbons with dispersion for all three oils. Consequently, the risk of PAH toxicity to pelagic species of fish, especially to sensitive life stages such as eggs and larvae, is enhanced by chemical dispersion. The effectiveness of Corexit EC9500 was most pronounced on Terra Nova oil, while Mesa oil had the greatest induction potential. Dispersing these oils would cause sublethal exposures to PAH, with Mesa potentially having a greater sublethal effect. Scotian Light was the most toxic by virtue of its higher solubility and reached a lethal concentration limit during dispersion.

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References

Anderson, J.W., Neff, J.M., Cox, B.A., Tatem, H.E., Hightower, G.M., 1974. Characteristics of dispersions and water-soluble extracts of crude and refined oils and their toxicity to estuarine crustaceans and fish. Mar. Biol. 27, 75–88.

Bobra, A.M., Shiu, W.Y., MacKay, D., Goodman, R.H., 1989. Acute toxicity of dispersed fresh and weathered crude oil and dispersants to *Daphnia magna*. Chemosphere 19, 1199–1222.

Canevari, G.P., 1978. Some observations on the mechanism and chemistry aspects of chemical dispersion. In: McCarthy, L.T.J., Lindblom, G.P., Walter, H.F. (Eds.), Chemical Dispersants for the Control of Oil Spills. Am. Soc. Testing and Materials, Philadelphia, pp. 2–5.

Carls, M.G., Rice, S.D., Hose, J.E., 1999. Sensitivity of fish embryos to weathered crude oil: Part 1. Low-level exposure during incubation causes malformations, genetic damage, and mortality in larval pacific herring (*Clupea pallasi*). Environ. Toxicol. Chem. 18, 481–493.

Carr, R.S., Linden, O., 1984. Bioenergetic responses of *Gammarus salinus* and *Mytilus edulis* to oil and oil dispersants in a model ecosystem. Mar. Ecol. Progr. Ser. 19 (3), 285–292.

CCME, 2000. Reference Method for the Canada Wide Standard for Petroleum Hydrocarbons in Soil. Draft Copy of CCME—Tier 1 Method, Canadian Council of Ministers of the Environment, Winnipeg, Man., Canada.

Cohen, A.M., Nugegoda, D., 2000. Toxicity of three oil spill remediation techniques to the Australian bass *Macquaria novemaculeata*. Ecotoxicol. Environ. Saf. 47, 178–185.

Cohen, A.M., Nugegoda, D., Gagnon, M.M., 2001. The effect of different oil spill remediation techniques on petroleum hydrocarbon elimination in Australian bass *Macquaria novemaculeata*. Arch. Environ. Contam. Toxicol. 40, 264–270.

Cotou, E., Castritsi-Catharios, I., Moraitou-Apostolopoulou, M., 2001. Surfactant-based oil dispersant toxicity to developing nauplii of *Artemia*: effects on atpase enzymatic system. Chemosphere 42, 959–964.

Fingas, M., 1995. Oil spills and their cleanup. Chem. Ind. 24, 1005–1008.

Fragoso, N., Parrott, J.L., Hahn, M.E., Hodson, P.V., 1998. Chronic retene exposure causes sustained induction of CYP1A activity and protein in rainbow trout (*Oncorhynchus mykiss*). Environ. Toxicol. Chem. 17, 2347–2353.

Fucik, K., 1994. Dispersed oil toxicity tests with species indigenous to the Gulf of Mexico. Technical Summary: Minerals Management Service Publication 94-0021, Gulf of Mexico Region, Environmental Information, US Department of the Interior, New Orleans, LA, USA.

Gagnon, M.M., Holdway, D.A., 2000. EROD induction and biliary metabolite excretion following exposure to the water accomodated fraction of crude oil and to chemically dispersed crude oil. Arch. Environ. Contam. Toxicol. 38, 70–77.

Garcia-Blanco, S., Motelab, M., Venosa, A.D., Suidan, M.T., Lee, K., King, D.W., 2001. Restoration of the oil contaminated St. Lawrence River shoreline: bioremediation and phytoremediation. In: Proceedings of the 2001 Oil Spill Conference. Am. Petroleum Inst., Washington, DC, pp. 303–308.

Getter, C.D., Baca, B.J., 1984. A laboratory approach for determining the effects of oils and dispersants on mangroves. In: Allen, T.E. (Ed.), Oil Spill Chemical Dispersants: Research, Experience, and Recommendations, STP 840. Am. Soc. Testing and Materials, Philadelphia, pp. 5–13.

Gilbert, T., 1996. Dispersant use/oil/sea temperature suitability matrix and oil chemistry and the impact on the effectiveness of chemical dispersants. Sixth Scientific Support Coordinators Workshop, Launceston, Tasmania, Australia. Australian Maritime Safety Authority, Canberra, ACT 2601, Australia, URL: http://www.amsa.gov.au/me/netplan/disper.htm

Girling, A.E., Whale, G.F., Adema, D.M.M., 1994. A guideline supplement for determining the aquatic toxicity of poorly water-soluble complex mixtures using water-accommodated fractions. Chemosphere 29, 2645–2649.

Hartwick, E.B., Wu, R.S.S., Parker, D.B., 1982. Effects of a crude oil and a oil dispersant (Corexit 9527) on populations of the littleneck clam (*Protothaca staminea*). Mar. Environ. Res. 6, 291–306.

Hodson, P.V., Efler, S., Wilson, J.Y., El-Shaarawi, A., Maj, M., Williams, T.G., 1996. Measuring the potency of pulp mill effluents for induction of hepatic mixed function oxygenase activity in fish. J. Toxicol. Environ. Health 49, 101–128.

Hodson, P.V., Ibrahim, I., Zambon, S., Ewert, A., Lee, K., 2002. Bioavailability to fish of sediment PAH as an indicator of the success of in situ remediation treatments at an experimental oil spill. Bioremediat. J. 6 (3), 297–313.

Law, A.T., 1995. Toxicity study of the oil dispersant Corexit 9527 on *Macrobrachium rosenbergii* (de Man) egg hatchability by using a flow-through bioassay technique. Environ. Pollut. 88, 341–343.

Lewis, A., Aurand, D., 1997. Putting dispersants to work: overcoming obstacles. 1997 International Oil Spill Conference Issue Paper,

Technical Report No. IOSC-004.23. Am. Petroleum Inst., Washington, DC.

Linden, O., 1974. Effects of oil dispersants on the early development of Baltic Herring. Ann. Zool. Fennici 11, 141–148.

Linden, O., 1975. Acute effects of oil and oil/dispersant mixture on larvae of Baltic herring. Ambio 4, 130–133.

Nelson-Smith, A., 1977. Effects of dispersant use on shore life. In: McCarthy Jr., L.T., Lindblom, G.P., Walter, H.F. (Eds.), Chemical Dispersants for the Control of Oil Spills, ASTM STP 659. Am. Soc. Testing and Materials, Philadelphia, pp. 18–34.

Singer, M.M., Aurand, D., Bragins, G.E., Clarks, J.R., Coelho, G.M., Sowby, M.L., Tjeerdema, R.S., 2000. Standardization of the preparation and quantitation of water-accommodated fractions of petroleum for toxicity testing. Mar. Pollut. Bull. 40 (11), 1007–1016.

Singer, M.M., George, S., Benner, D., Jacobson, S., Tjeerdema, R.S., Sowby, M.L., 1993. Comparative toxicity of two oil dispersants to the early life stages of two marine species. Environ. Toxicol. Chem. 12, 1855–1863.

Singer, M.M., George, S., Jacobson, S., Lee, I., Weetman, L.L., Tjeerdema, R.S., Sowby, M.L., 1996. Comparison of acute aquatic effects of the oil dispersant Corexit 9500 with those of other Corexit series dispersants. Ecotoxicol. Environ. Saf. 35, 183–189.

Smith, J.E., 1968. "Torrey Canyon" Pollution and Marine Life. Cambridge University Press, Cambridge House, Cambridge, UK, pp. 23–25.

Thomas, R.E., Rice, S.D., 1981. Excretion of aromatic hydrocarbons and their metabolites by freshwater and seawater Dolly Varden char. In: Vernberg, F.J., Calabrese, A., Thurberg, F., Vernberg, W. (Eds.), Biological Monitoring of Marine Pollutants. Academic Press, New York, pp. 425–448.

Volkmann, J.K., Miller, G.J., Revill, A.T., Connell, D.W., 1994. Oil spills. In: Swan, J.M., Neff, J.M., Young, P.C. (Eds.), Environmental Implications of Offshore Oil and Gas Development in Australia—The Findings of an Independent Review. Australian Petroleum Exploration Assoc., Sydney, Australia, pp. 509–695.

General Coral Reef Facts

Healthy coral reefs are among the most biologically diverse and economically valuable ecosystems on earth, providing valuable and vital ecosystem services.

Coral ecosystems are a source of food for millions; protect coastlines from storms and erosion; provide habitat, spawning and nursery grounds for economically important fish species; provide jobs and income to local economies from fishing, recreation, and tourism; are a source of new medicines, and are hotspots of marine biodiversity. They also are of great cultural importance in many regions around the world, particularly Polynesia

Based on current estimates, shallow water coral reefs occupy approximately 284,300 square kilometers (110,000 square miles) of the sea floor. If all of the world's shallow water coral reefs were placed side-by-side, they would occupy an area a bit larger than the state of Texas.

The total area of coral reefs represents less than 0.015 percent of the ocean. Yet coral reefs harbor more than one quarter of the ocean's biodiversity. No other ecosystem occupies such a limited area with more life forms.

Reefs are often compared to rainforests, which are the only other ecosystem that can boast anywhere near the amount of biodiversity found on a reef. Coral reefs are sometimes called rainforests of the seas.

Oil spills and coral reefs

NOAA has produced two summary documents on corals and oil spills:

a guide for planning and incident response (http://response.restoration.noaa.gov/book_shelf/70_coral_full_report.pdf)

and a synthesis of previous research on oil effects to corals (http://response.restoration.noaa.gov/book_shelf/1_coral_tox.pdf).

In 2005, NOAA conducted an exercise to test emergency response to a simulated oil spill in the Florida Keys (http://sanctuaries.noaa.gov/safeseas/pdfs/safeseas2005.pdf).

Impacts of oil spills to coral reefs are difficult to predict because each spill presents a unique set of physical, chemical, and biological conditions. How corals are exposed to oil—and the composition of the oil at the time of impact—bears directly on how serious the impact will be.

There are three primary modes of exposure for coral reefs in oil spills:

- Direct oil contact is possible when surface oil is deposited on intertidal corals that live near the surface of the water and become exposed with the tides.
- Rough seas and a light, soluble oil can combine to mix the oil into the water below the surface, where it can impact corals. Corals are exposed to less oil beneath the water surface, but the lighter oil components that mix easily are often the most toxic.

- Subsurface oiling can occur when heavy oils weather, or mix with sediment material. This increases the density of the oil to the point where it may actually sink, potentially smothering corals.

Oil Spill Response Strategies for Coral Reefs
Booms are sometimes used to control the movement of oil at the water surface. This should be done carefully in coral reef areas, as boom anchors can physically impact corals, especially when booms are moved around by waves.

Dispersants act like detergents, breaking an oil slick into droplets that mix into the water column, where they dilute and eventually biodegrade. Dispersants work best on light oils, and are less effective on oil that has been extensively weathered or in areas of low water movement. Dispersants offer a trade-off of oil effects in the water versus at the shoreline. The use of dispersants over shallow submerged reefs is generally not recommended, but the potential impacts to the reef should be weighed against impacts that might occur to birds, mammals, turtles, and sensitive shoreline resources (such as mangroves) where it is extremely difficult to clean the oil.

Effects of oil and dispersants on coral reefs
Laboratory, field studies, and actual oil spill events often appear to show contradictory results for effects of oil and dispersants on coral reefs.

The old notion that coral reefs do not suffer acute toxicity effect from oil floating over them is probably incorrect. Direct contact with spilled oil can lead to coral death, but depends on coral species, growth form, life stage, and type/duration of oil exposure.

Longer exposure to lower levels of oil may kill corals, as well as shorter exposure to higher concentrations. Death may not be immediate, but rather take place long after the exposure has ended.

Instead of acute mortality, it is more likely that oil effects occur in sublethal forms, such as reduced photosynthesis, growth, or reproduction. Early developmental forms (like coral larvae) are particularly sensitive to toxic effects, and oil slicks can significantly reduce larval development and viability.

Coral communities may recover more rapidly from oil exposure alone than from mechanical damage. Recovery of coral reefs after oil exposure, however, may depend partly on the recovery of associated communities (e.g. nursery or foraging habitats, such as mangroves and seagrasses) that may be more seriously affected than the reef itself. Recovery time depends on the type and intensity of the disturbance and can range from several years to decades.

Past Oil Spills Impacts to Coral Reef Ecosystems
One extensively studied spill occurred at Bahia Las Minas, Panama in April, 1986. An estimated 60,000-100,000 barrels of medium weight crude oil spilled into the waters of the bay, causing widespread lethal and sub-lethal effects to coral.

In contrast, in the Arabian (Persian) Gulf Spill in January 1991, the largest oil spill in history, an estimated 6.3 million barrels of oil were released. Given the magnitude of this release and the coral reef impacts noted at other tropical spills, there were dire expectations of severe impacts to reefs in Kuwait and Saudi Arabia. However, to date, the extent of coral reef damage directly attributable to the Gulf Spill has been remarkably minor.

What you can do
NOAA's comprehensive efforts in response to the Deepwater Horizon event can be found at http://www.incidentnews.gov/incident/8220. Because oil is a hazardous material, volunteer opportunities are limited for unaffiliated, untrained volunteers. To report oiled shorelines or request volunteer information, please call 281-366-5511 or 866-448-5816.

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ALTERATION OF NORMAL CELLULAR PROFILES IN THE SCLERACTINIAN CORAL (*POCILLOPORA DAMICORNIS*) FOLLOWING LABORATORY EXPOSURE TO FUEL OIL

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Abstract—Petroleum contamination from oil spills is a continuing threat to our ocean's fragile ecosystems. Herein, we explored the effects of the water-soluble fraction of crude oil on a stony coral, *Pocillopora damicornis* (Linneaeus 1758). We developed methods for exposing corals to various concentrations of crude oil and for assessing the potential molecular responses of the corals. Corals were exposed to water-accommodated fraction solutions, and appropriate cellular biomarkers were quantified. When compared to the ''healthy'' control specimens, exposed corals exhibited shifts in biomarker concentrations that were indicative of a shift from homeostasis. Significant changes were seen in cytochrome P450 1-class, cytochrome P450 2-class, glutathione-*S*-transferase-pi, and cnidarian multixenobiotic resistance protein-1 biomarkers, which are involved the cellular response to, and manipulation and excretion of, toxic compounds, including polycyclic aromatic hydrocarbons. A shift in biomarkers necessary for porphyrin production (e.g., protoporphyrinogen oxidase IX and ferrochelatase) and porphyrin destruction (e.g., heme oxygenase-1 and invertebrate neuroglobin homologue) illustrates only one of the cellular protective mechanisms. The response to oxidative stress was evaluated through measurements of copper/zinc superoxide dismutase-1 and DNA glycosylase MutY homologue-1 concentrations. Likewise, changes in heat shock protein 70 and small heat shock proteins indicated an adjustment in the cellular production of proteins. Finally, the results of this laboratory study were nearly identical to what we observed previously among corals of a different species, *Porites lobata*, exposed to an oil spill in the field after the grounding of the Merchant Vessel *Kyowa Violet.*

Keywords—Coral   Oil spill   Biomarker   Antibody   Cellular diagnostics

INTRODUCTION

The expanding human interaction with the ocean environment has greatly affected the ocean's fragile ecosystems [1,2]. Specifically, petroleum contamination has been—and continues to be—a serious threat. Petroleum products, such as the petrochemicals used to make plastics and synthetic fibers and the oil and gas used for heat, energy, and fuel, are intimately involved with today's society. Despite the practical necessities, increased transport of petrochemicals over the world's oceans has the potential to affect our environment severely. In fact, oil spills are inevitable [3]. Although rapid action usually is taken either during or soon after spills to cleanse oil contamination on the water surface, water-soluble components of the oil remain fractionated within the water column or may be sequestered in sediments. This water-accommodated fraction (WAF) allows the contaminants to remain after the superficial cleaning activities and, thereby, causes a potential disruption in the homeostasis of any marine organisms it contacts.

It is well documented that petroleum products can affect aquatic organisms at different levels of organization. Studies of marine fishes, following environmental or laboratory exposure to petroleum products or by-products (e.g., polycyclic aromatic hydrocarbons [PAHs]), have provided strong evidence linking pollution to increases in the number of structural anomalies [4,5], developmental complications [6,7], behavioral changes [8,9], and diseases [10,11]. The time to appearance of these anomalies can range from several days to months after the initial exposure. However, cellular responses to pollutants are immediate and can indicate changes in the organism's cellular homeostasis.

The exposure of coral reef ecosystems to crude petroleum and, particularly, intermediate fuel oil (IFO) grade 180, a common grade of marine fuel used in tanker transport, is of interest following the grounding of the Merchant Vessel *Kyowa Violet* in December 2002, during which approximately 55,000 to 80,000 gallons spilled into the coral reef ecosystem off Colonia Harbor, Yap, Federated States of Micronesia. Our recent assessment of the corals affected by the spill suggested that the sublethal effects of this fuel-oil spill adversely affected coral reef health [12]. The present study was the logical extension of our previous in situ study and focused on whether the water-soluble fraction of marine fuel oil can cause a rapid shift in homeostasis of a widely distributed and well-studied coral following a controlled laboratory exposure. Specifically, we developed a methodology to expose corals to various concentrations of the water-soluble components of IFO 180 marine fuel oil, the same compounds that have been implicated in the *Kyowa Violet* spill. We utilized this approach to compare and contrast the response of exposed and reference specimens of the reef-building coral, *Pocillopora damicornis*.

MATERIALS AND METHODS

Maintenance of corals

Pocillopora damicornis (Linnaeus 1758) colonies were obtained from Aquatic Aquaculture (Mardela Springs, MD,

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USA). Corals were maintained in 209-L aquaria at 26°C and a salinity of 38 ppt created with Instant Ocean™ Sea Salt mix (Aquarium Systems, Mentor, OH, USA) and deionized water. The closed aquarium system was illuminated by a Coralife™ metal 175-W halide bulb (Energy Savers Unlimited, Lafayette, CA, USA) on a 10:14-h light:dark photoperiod. Water changes of 10 L were made twice weekly with newly mixed seawater. In addition, 700 μl of Reef Success Vita Vitamins (Red Sea, Tel Aviv, Israel), 700 μl of Reef Success Iodine (Red Sea), and 700 μl of Reef Success Coral Trace (Red Sea) were added to the tank's protein skimmer with each water change. The corals were fed 5 ml of PhytoPlex (Kent Marine, GA, USA) once every other day.

Once the coral colonies were acclimatized to the laboratory setting for two weeks, 1- to 2-cm pieces were clipped from a single coral colony and glued individually to glass microscope slides using Instant Krazy Glue (Elmers, Columbus, OH, USA), which caused no deleterious effect to the coral (results not shown). The slides were returned to the aquaria, and the corals left to stabilize for two weeks before exposure. The experiment used a total of 16 coral fragments (i.e., four slides per exposure concentration).

Water-accommodated fraction

The WAF was generated using IFO 180 marine fuel oil samples, which were a generous donation from ExxonMobil Marine Fuels (New York, NY, USA) and Oil Testing Services (Lafayette, NJ, USA). Instant Ocean Sea Salt mix was combined with distilled water to create the 38-ppm salt water. Various concentrations of WAF were made separately using the variable-loading method instead of diluting a higher concentration solution [13,14]. One liter of salt water was added to 1-L, Teflon®-coated containers (Savillex, Minnetonka, MN, USA). Appropriate quantities of crude oil (0.25, 1, and 4 g) were weighed and added to each container along with the salt water. The solutions were mixed with a 4-cm, Teflon-coated stirbar on a magnetic stirrer for 24 h at ambient temperature. Additional solutions were prepared for each WAF concentration to allow water changes during the exposure period. Unaltered salt water was used as a control.

Exposure

One-liter glass beakers served as dosing chambers for the corals. The beakers were placed in heated water baths to maintain water temperature at 26°C, and glass Pasteur capillary pipettes were connected to individual aquarium air pumps and placed in each dosing chamber for aeration and water circulation. Four slides, each containing an individual coral piece, were placed at the bottom of each of the beakers. The slides were arranged in a square formation, as shown in Figure 1. Before addition of each WAF solution to the beaker, the solutions were poured into a separatory funnel to isolate the fraction of crude oil that did not dissolve in the seawater [14]. The coral samples were exposed to the various WAF concentrations for a 24-h period, with water changes performed every 8 h to avoid ammonia and nitrate accumulation for all exposed and reference groups [15].

Sample preparation

Samples were assayed as described previously [12,16]. After the 24-h exposure, each of the individual coral pieces was frozen and then ground to a fine powder in liquid nitrogen using a mortar and pestle. Approximately 0.5 g of the ground

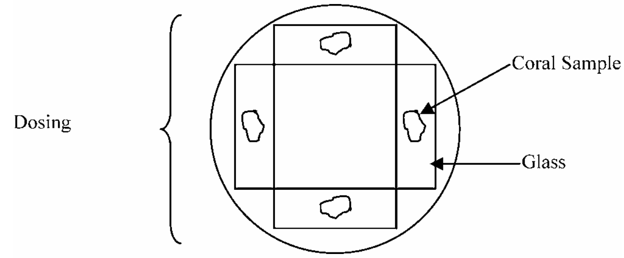

Fig. 1. Exposure of corals. Four slides, each containing an individual coral piece, were placed at the bottom of each of the exposure chamber. The slides were arranged in a square pattern as depicted. Corals were incubated with exposure solutions at 26°C with constant aeration.

sample powder was placed in a locking, 1.8-ml microcentrifuge tube along with 1,400 μl of a denaturing buffer consisting of 2% sodium dodecyl sulfate (SDS), 50 mM Tris(hydroxymethyl) aminomethane (pH 7.8), 15 mM dithiothreitol, 10 mM ethylenediaminetetra-acetate, 3% (w/v) polyvinylpolypyrrolidone, 0.005 mM salicylic acid, 0.001% dimethyl sulfoxide, 0.01 mM 4-(2-aminoethyl)-benzenesulfonyl fluoride, 0.04 mM bestatin, 0.001 mM E-64, 2 mM phenylmethylsulfonyl fluoride, 2 mM benzamide, 5 μM amino-caproic acid, and 1 μg/100 μl of pepstatin A. Samples were then vortexed for 15 s, heated at 93°C for 6 min with occasional additional vortexing, and incubated at 25°C for 10 min. Samples were centrifuged (13,500 *g* for 8–10 min), and the middle-phase supernatant was aspirated and placed in a new Eppendorf tube [16] and subjected to a protein concentration assay according to the method described by Ghosh et al. [17].

Electrophoresis

One-dimensional SDS–polyacrylamide gel electrophoresis (PAGE) and Western blot analysis were used to optimize the separation of target proteins and to validate the use of specific antibodies with *P. damicornis* protein extracts [18]. Total soluble protein (15–40 μg) from three randomly prepared samples from the same coral colony was loaded onto a 12.5% SDS-PAGE preparative gel. A Tris(2-carboxyethyl) phosphine (neutral pH) concentration of 0.001 M was added to the gels [19]. All gels were blotted onto polyvinylidene fluoride membranes using a wet-transfer system [20,21]. The membranes were blocked in 5% nonfat dry milk and assayed with a primary antibody for 1 h. The blots were then washed in Tris-buffered saline four times and incubated in a horseradish peroxidase–conjugated secondary antibody solution for 1 h at a 1:30,000 titer (Jackson ImmunoResearch Laboratories, Westport, PA, USA). Blots were washed again four times in Tris-buffered saline and developed using a Western Lightning Plus (New England Nuclear, Shelton, CT, USA) luminol/hydrogen peroxide–based chemiluminescent solution and documented using a Genegnome luminescent documentation system (Syngene, Frederick, MD, USA). To ensure a minimum of nonspecific cross-reactivity, blots were developed for at least 3 min. Calibration of a quantitative standard showed that 0.05 attomole of target protein could be detected at this level of sensitivity (results not shown).

Enzyme-linked immunosorbent assay experiments

Once validated, antibodies and samples were optimized for the enzyme-linked immunosorbent assay using 384-well microplates in an 8 × 6 × 4 factorial design [17,22] and assayed using a Beckman Coulter Biomek 2000 Laboratory Automa-

Table 1. Biomarker expression[a]

Cellular parameter	Control	0.25 g/L	1 g/L	4 g/L
Protein Metabolic Condition				
Hsp70 (cnidarian)	0.077 ± 0.019A	0.201 ± 0.039B	0.253 ± 0.055BC	0.286 ± 0.054C
sHsp (cnidarian)	BDL	0.048 ± 0.015B	0.117 ± 0.046B	0.113 ± 0.034B
Oxidative Damage and Response				
Cu/ZnSOD (cnidarian)	0.003 ± 0.001A	0.007 ± 0.001A	0.022 ± 0.011B	0.007 ± 0.001A
MutY	0.004 ± 0.001A	0.009 ± 0.003B	0.013 ± 0.003B	0.013 ± 0.003B
Porphyrin Metabolism				
Protopophyrinogen oxidase IX	0.029 ± 0.004A	0.064 ± 0.010B	0.044 ± 0.008A	0.043 ± 0.004A
Ferrochelatase (cnidarian)	0.030 ± 0.004A	0.060 ± 0.004AB	0.091 ± 0.031B	0.079 ± 0.021B
Neuroglobin (invertebrate)	2.348 ± 0.342A	3.688 ± 0.723AB	4.236 ± 0.830B	4.742 ± 0.725B
Heme oxygenase-1	0.036 ± 0.016A	0.174 ± 0.150AB	0.265 ± 0.130B	0.484 ± 0.035C
Xenobiotic Response				
CYP P450 1-class	0.002 ± 0.001A	0.067 ± 0.041AB	0.116 ± 0.053B	0.089 ± 0.018B
CYP P450 2-class	0.074 ± 0.010A	0.037 ± 0.015B	0.052 ± 0.015AB	0.037 ± 0.012B
CYP P450 6-class	0.056 ± 0.011A	0.198 ± 0.267A	0.038 ± 0.007A	0.033 ± 0.008A
GST (cnidarian)	0.0015 ± 0.0006A	0.031 ± 0.012B	0.035 ± 0.010B	0.032 ± 0.012B
MXR-1 (cnidarian)	0.006 ± 0.003A	0.028 ± 0.013B	0.054 ± 0.011C	0.055 ± 0.007C

[a] Treatment means with different uppercase letters differed significantly at $\alpha = 0.05$ using the three different posthoc tests described in *Materials and Methods*. All units, except where noted, are expressed as femol target analyte/ng total soluble protein. Values are presented as the mean ± standard error ($n = 4$). BDL = below detection limit; Cu/ZnSOD = copper/zinc superoxide dismutase-1; CYP = cytochrome; GST = glutathione-*S*-transferese; Hsp70 = heat shock protein 70; MutY = DNA glycosylase MutY homologue; MXR-1 = multixenobiotic resistance protein-1; sHsp = small heat shock proteins.

tion Workstation (Promega, Madison, WI, USA). Algal (i.e., dinoflagellate) and host extracts (cnidarian) were assayed using the following antibodies (with accompanying catalog numbers) from Envirtue Biotechnologies (Winchester, VA, USA): Algal anti–glutathione peroxidase (AB-1484), algal anti–manganese superoxide dismutase (AB-1501), algal anti–copper/zinc superoxide dismutase (AB-CZ1546), algal anti–glutathione-*S*-transferase (AB-1491), algal anti–heat shock protein 60 (AB-1506), anti–chloroplast small heat shock protein (AB-1), cnidarian anti–heat shock protein 60 (AB-1508), cnidarian anti–heat shock protein 70 (AB-Hsp70-1517), cnidarian anti–heat shock protein 90 (AB-Hsp90-1685), cnidarian anti–manganese superoxide dismutase (AB-1976), cnidarian anti–copper/zinc superoxide dismutase (AB-SOD-1516), cnidarian anti–glutathione peroxidase (AB-GPX-1433), cnidarian anti–small heat shock protein (AB-H105), cnidarian anti–ferrochelatase (AB-FC-1939), cnidarian anti–cytochrome P450 6-class homologue (AB-C6-2), cnidarian anti-metallothionein (AB-MM-10843), cnidarian anti–heme oxygenase-1 (AB-HO-1944), anti-ubiquitin (AB-U100), and anti–multixenobiotic resistance protein (ABC family of proteins). All samples were assayed in triplicate with intraindividual variation of less than 8% for the entire 384-well microplate (Table 1), and in addition, an eight-point calibration curve using a calibrant relevant to each antibody was plated in sextupilicate for each plate (results not shown). Based on data from our field study [12] and what we were able to detect with the antibodies listed above, we elected to focus our efforts on those biomarkers most likely to exhibit a response in this laboratory study.

Biomarkers

Cellular biomarkers serve as diagnostic tools to indicate variations in the physiological condition of an organism in response to environmental change. This is achieved by quantifying changes in the cellular and molecular processes of the cells. In the present study, certain biomarkers were grouped together for analysis. Each category encompasses biomarkers involved in a cellular process that would be expected to vary in response to specific types of stressors. The four diagnostic groups and incorporated biomarkers included Xenobiotic Response (cnidarian cytochrome P450 1-class [CYP P450 1-class], cnidarian cytochrome P450 2-class [CYP P450 2-class], cnidarian cytochrome P450 6-class [CYP P450 6-class], glutathione-*S*-transferase [GST-pi], and cnidarian multixenobiotic resistance protein-1 [MXR-1]), Porphyrin Metabolism (protoporphyrinogen oxidase IX [PPO], cnidarian ferrochelatase [FC], invertebrate neuroglobin homologue [globin], and heme oxygenase-1 [HO-1]), Oxidative Damage and Response (copper/zinc superoxide dismutase-1 [Cu/ZnSOD] and DNA glycosylase MutY homologue [MutY]), and Protein Metabolic Condition (heat shock protein 70 [Hsp70] and cnidarian small heat shock proteins [sHsp]).

Statistical analysis

Normality of the data was tested using the Kolmogorov–Smirnov test with Lilliefors' correction, and equality of variance was verified using the Levene median test. A one-way analysis of variance (ANOVA) was used if the data were found to be normally distributed and homogeneous. However, if the data did not meet the requirements for homogeneity of variances for the one-way ANOVA, the Kruskal–Wallis one-way ANOVA on ranks was used to compensate. The Tukey–Kramer honestly significant difference method or the Dunn's post hoc test was used when significant differences between the treatment means were found, depending on the variances [23,24]. Statistical significance was defined as $p < 0.05$.

We used canonical correlation analysis (CCA) as a heuristic tool to illustrate how biomarkers could be used to discriminate among populations. The CCA is a method of eigen analysis that reveals the basic relationship between two matrices—in our case, those of four exposures and the biomarker data. The CCA provided an objective statistical tool for determining if exposures were different from one another using sets of cellular biomarkers indicative of a cellular process and, if so, which biomarkers contributed to those differences. This analysis required combining data from all four exposures into one matrix, which we did by expressing biomarker response in a given population as a proportion of their mean levels.

RESULTS

Significant changes were seen in CYP P450 1-class, CYP P450 2-class, GST-pi, and MXR-1, all of which are involved in the cellular response, manipulation, and excretion of toxicants. Likewise, we observed changes in the expression of biomarkers involved in porphyrin production (e.g., PPO and FC) and porphyrin destruction (e.g., HO-1 and globin), which are necessary for cell protection. The corals' responses to oxidative stress and damage were evaluated through alterations in Cu/ZnSOD and MutY concentrations, and changes in Hsp70 and sHsp indicated an adjustment in the cells' production of proteins. Finally, the present results are consistent with preliminary results from our earlier trials at these exposure levels.

Xenobiotic response

Although CYP P450 1-class expression was elevated for all the exposure levels (Table 1), significant differences between the control and the WAF concentrations were seen only in the 1 and 4 g/L treatments. Levels in the 0.25 g/L exposure were not significantly increased. In contrast, the dose responses for CYP P450 2-class showed a significant decrease in expression from the control at exposures of 0.25 and 4 g/L, but not for the 1 g/L (0.052 ± 0.015 fmol/ng total soluble protein) exposure (Table 1). No difference from the control was observed among any of the CYP P450 6-class exposures (Table 1).

The expression of GST-pi increased significantly for all exposures in a nearly identical manner. The MXR-1 expression was significantly higher than that in the control for all the exposures. Among the exposures, a twofold increase was observed between 0.25 g/L and the two higher exposures of 1 and 4 g/L.

Porphyrin metabolism

Protoporphyrinogen oxidase IX expression among control specimens was not significantly different from that in corals in the 1 and 4 g/L exposures. However, expression in the 0.25 g/L exposure was significantly higher than that observed in all other exposures (Table 1). Conversely, FC expression was significantly elevated in the 1 and 4 g/L exposures, but not in the 0.25 g/L treatment. Likewise, globin was significantly increased in the 1 and 4 g/L exposures, but not in the 0.25 g/L exposure (Table 1). Heme oxygenase-1 expression, despite the apparent increase between the control and 0.25 g/L exposure, was not significantly different among treatments. However, levels in corals from the 1 and 4 g/L exposures were significantly increased compared to those of the control corals and to each other (Table 1).

Oxidative damage and response

Copper/zinc superoxide dismutase-1 control expression was not significantly different from corals in the 0.25 and 4 g/L exposures. However, the 1 g/L treatment samples showed a significant elevation from the control and the other exposures. The MutY expression was significantly increased from the control in all exposures (Table 1).

Protein metabolic condition

The Hsp70 expression was significantly elevated for all exposures compared to the control coral specimens. Moreover, a statistically significant increase was further noted at concentrations higher than 0.25 g/L. Despite a significant difference from the control, the 1 g/L exposure did not differ from the 0.25 and 4 g/L exposures. The sHsp expression revealed a significant increase in all exposures (Table 1).

DISCUSSION

Exposure to petroleum mixtures may result in a number of pathologies, ranging from anemia (interference in heme metabolism and function) to degeneration of cilia in gastrodermal cells in both mammals and cnidarians [25]. These pathologies arise as a result of mechanistic toxicities occurring on the biochemical and subcellular levels. Examining biomarkers that reflect the performance of these biochemical and subcellular processes can generate a dose-dependent profile of the types of stressors affecting the organism and facilitate a deeper comprehension of the nature of the toxicological mechanisms associated with a petroleum exposure. A serial concentration-exposure experimental design, as reported herein, allowed us to test for the occurrence of a dose–response behavior of the organism to the toxicant and demonstrated the occurrence of an emergent response to increasing concentrations (e.g., accumulation of protoporphyrin at low-concentration exposure and hemolytic anemia at higher-concentration exposure) [26]. Furthermore, understanding how key metabolic and cellular responses are affected by a serial exposure to IFO 180 marine fuel also may support a more accurate prediction of how higher-order physiological processes may behave.

Xenobiotic response

When any noxious pollutants or xenobiotics enter a cell and its compartments, the cell initiates the process of biotransformation to avoid injury. This biological process is composed of three sequential steps or phases, involving specific proteins.

Phase-1 responses include enzymatic reactions that alter the xenobiotics through addition or exposure of polar groups, such as hydroxyl, carboxyl, thiol, and amino, on the toxicant. This is a necessary step for the phase-2 proteins to interact with the altered xenobiotics. Reactions such as oxidation, reduction, and hydrolysis are used for the polar group tags [27–29]. Phase-3 enzymes allow the xenobiotics to be exported out of the cell. However, it is possible, depending on the reaction, that an even more toxic metabolite is formed [29]. Our study focused predominantly on the superfamily of cytochrome P450s, which are mainly associated with oxidative and hydrolytic processes during phase 1 [28].

Cytochrome P450s are heme-containing monooxygenases. In many species, most members of this superfamily are involved in the metabolism of xenobiotics; however, a limited number of cytochrome P450s are associated with biosynthetic pathways of steroid and bile acid production [30,31]. In the present study, we focused on specific families of cytochrome P450s, namely the CYP P450 1-, 2-, and 6-classes. These particular classes were chosen because of their metabolic interaction with specific kinds of molecules. Cytochrome P450 1-class associates with PAHs [31], whereas CYP P450 2-class interacts with a wide range of steroids and xenobiotic substances [32] and CYP P450 6-class with pesticides containing chlorinated side chains [32,33].

Canonical correlation analysis indicated significant changes in the response to the WAF exposure (Fig. 2). For the cytochrome P450s, these changes were found in the responses of CYP P450 1- and 2-class comparisons (Fig. 2A). In the CYP P450 1-class, this response suggests that the corals were reacting to the PAH as well as to benzene, toluene, ethylbenzene, and xylene, all of which are components of the IFO 180. It

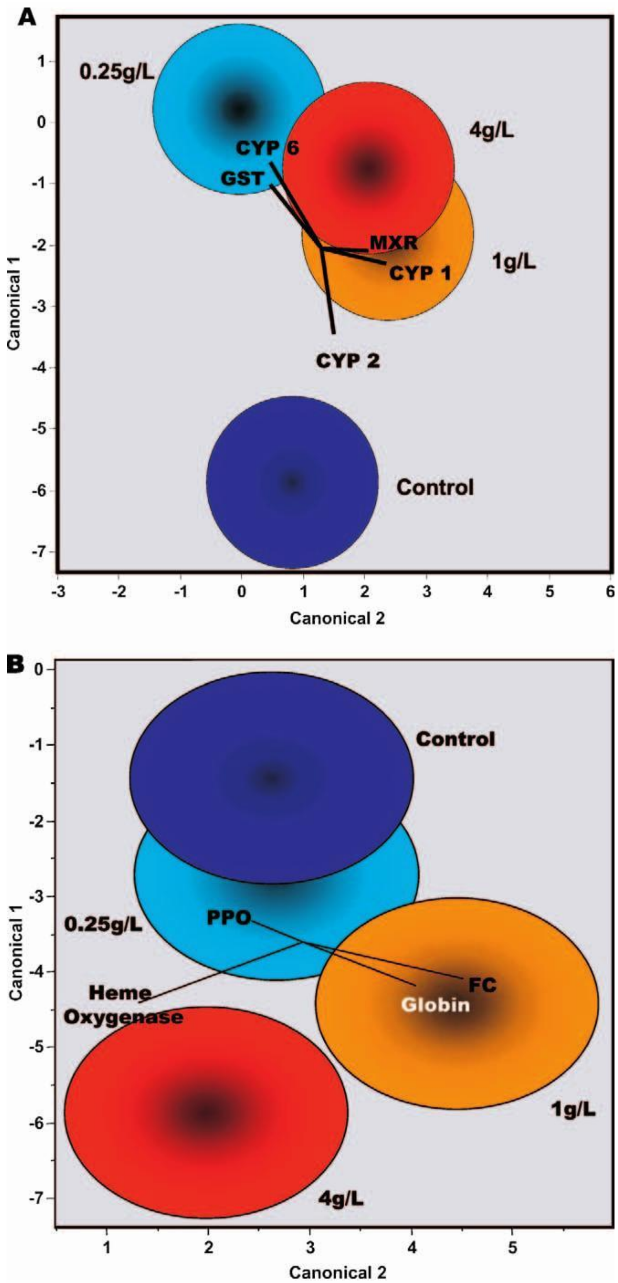

Fig. 2. Xenobiotic response and porphyrin metabolism biomarkers. Original variates were biomarker levels expressed as a percentage of the control value in each treatment. Circles show the 95% confidence intervals around the distribution centroid of each stressor. Biplot rays radiating from the grand mean show the directions of the original biomarker responses in canonical space. Overlapping centroids indicates that those populations are not significantly different from one another; nonoverlapping centroids indicate a statistically significant difference ($p < 0.05$). (**A**) Canonical centroid plot of Xenobiotic Response biomarkers (see *Materials and Methods*). (**B**) Canonical centroid plot of Porphyrin Metabolism biomarkers (see *Materials and Methods*). CYP = cytochrome; FC = cnidarian ferrochelatase; GST = glutathione-*S*-transferase; MXR = multixenobiotic resistance protein 1; PPO = protoporphyrinogen oxidase IX.

also was observed that a significant toxicity response was generated above the 1 g/L level. However, no dose–response effect was noticed as the WAF concentrations increased (Table 1). The response levels could be related to the amount of WAF of the fuel oil in the solution. In the 0.25 g/L solution, the concentration of aromatic hydrocarbons would be less than that found in preparations at the higher concentrations. It may be that CYP P450 1-class is a good indicator of the levels of aromatic hydrocarbon compounds in the environment. There also is a possibility that the cell becomes saturated in the process of producing CYP P450 1-class regardless of an increase in PAH exposure. The CYP P450 2-class levels were decreased for all doses tested (Table 1). This decrease in expression could correspond to a shift in subcellular response systems to compensate for the increase in the CYP P450 1-class elevation. Some fuel oil compounds in IFO 180 also could have adverse effects on the ability of cells to produce CYP P450 2-class enzymes, causing the observed decrease. No change in expression was seen for the CYP P450 6-class. This was expected, because the exposure to IFO 180 fuel oil lacks the chlorinated compounds that would elicit a response.

The new polar metabolites from phase 1 are a threat to the cell, because they can interact with or become embedded in the membrane. To prevent this, in phase 2, the metabolites are conjugated with endogenous substrates, such as glutathione, sulfates, acetates, and glucuronides [34]. The reactions of this phase cause the compounds to become more water soluble and, thus, capable of being excreted from the cell [35,36]. Of particular interest is the enzyme family of glutathione-*S*-transferases, which has been associated with the detoxification process in aerobic animals. The phase-2 enzyme, glutathione-*S*-transferase, primarily catalyzes the conjugation of electrophilic compounds, such as PAHs, with the thiol group of glutathione [35]. This reaction decreases the reactivity of the compounds with other molecules in the cell [37]. We focused on one of the four main classes of glutathione-*S*-transferase, GST-pi, which has been described in cnidarians [25]. Activity of GST-pi in our experiment was significantly elevated in response to exposure to the WAF, revealing activation of the detoxification response.

The third and final phase is the elimination of the altered metabolites. Depending on the end product, several different pathways exist. Compounds can be transported to the lysosome for degradation, sequestered in lysosome-like structures for containment, or ultimately, excreted from the cell [38,39]. Specific proteins, which help in the transport of xenobiotics out of the cell, are adenosine triphosphate–binding cassette transporters. One such phase-3 enzyme is MXR-1, which is used to export glutathione-conjugated compounds out of the cell [38]. An increase in the CYP P450 1-class (phase-1) as well as the GST-pi (phase-2) enzymes leads to an increase in the expression of MXR-1, as was observed. Although no dose–response effect was observed, the significant difference in the highest doses of the WAF (1 and 4 g/L) is in agreement with the responses seen in CYP P450 1-class.

Porphyrin metabolism

Is there a significant shift in porphyrin metabolism and catabolism as a result of increasing concentrations of IFO 180 WAF? Canonical correlation analysis indicated that the 0.25 g/L of IFO 180 WAF treatment did not cause a significant shift in porphyrin metabolism, but higher concentrations of IFO 180 WAF did (Fig. 2B). Porphyrins are heterocyclic molecules consisting of four pyrrole rings joined by methane bridges. Depending on the porphyrin, different substituents can be found on the ring. The biomarkers assessed included enzymes responsible for the synthesis of porphyrins or their deg-

radation. We focused on the final two steps of the porphyrin-synthesis pathway. Protoporphyrinogen oxidase IX is involved with the penultimate step of porphyrin production, and FC catalyzes the final step. In the penultimate step of porphyrin synthesis, coproporphyrinogen III is oxidized into protoporphyrin IX [40]. The final step is the insertion of iron into the porphyrin ring by FC to form a hemin [41]. An increase in protein levels of PPO and FC would be indicative of an increased demand in porphyrin anabolism, or it could result as a compensatory reaction of inhibited activities of PPO and FC enzymes. An increase in globin concentrations indicates either an increased demand for cellular oxygen, or it reflects increasing inhibitory activity of globin by petroleum components. The behavior of the protein levels of HO-1 in response to IFO 180 WAF exposure is similar to the behavior seen in other studies of HO-1 and petroleum exposure, suggesting an increased demand in heme degradation, most likely as a result of iron/porphyrin dissociation via PAH interactions [42].

Oxidative damage and response

Reactive oxygen species, such as superoxide radical anions and hydroxyl radicals, can stress an organism and cause cellular damage. Cells respond to this stress by releasing antioxidants to suppress these oxygen species [43]. Copper/zinc superoxide dismutase-1 is an antioxidant enzyme that protects the cell by catalyzing superoxides into hydrogen peroxide, which is then scavenged by further antioxidant pathways for further disposal [44]. In the present study, we observed a significant elevation of Cu/ZnSOD in the 1 g/L exposure concentration, whereas corals in the other exposures only exhibited a slight increase that was not statistically significant. The most reasonable explanation is that the cells became saturated at higher doses, which in turn inhibited the Cu/ZnSOD mechanism.

Reactive oxygen species also can cause damage at the subcellular level, producing lesions on the DNA. For example, MutY is involved in the base excision repair pathway of cells, and it is responsible for repairing oxidative damage to DNA [45]. The significant elevation that we observed among all the exposures could be indicative that DNA repair is occurring.

Protein metabolic condition

Protein production and turnover is a vital part of cellular homeostasis. Under normal conditions, when proteins leave the ribosome, they are bound by chaperones that help to ensure that the protein correctly folds into the native form. The chaperones also bind to misfolded or denatured proteins and prevent them from aggregating and causing cell damage. However, under stress conditions, the number of denatured proteins increases. In response, the cell up-regulates the genes that express the chaperones and are indicative of protein metabolic stress. Heat shock protein 70 is a cytosolic chaperone that binds to denatured proteins [46]. Small heat shock proteins are intrinsic chaperones, which are vital to protein conformation. The Hsp70 exhibited a significant dose–response effect as the IFO 180 WAF concentrations increased. Likewise, sHsp expression was significantly elevated in corals at all doses tested. However, no differences in expression among the increasing WAF concentrations were observed. Although this can signify that the coral samples were, indeed, stressed in their exposure to the WAF solutions and that a shift from metabolic homeostasis had occurred, both heat shock protein biomarkers are indicative of a general, nonspecific stress response that may be caused by other environmental factors.

Although not unexpected, the present results bear a remarkable similarity to those of our previous study of an oil spill on a coral reef in Yap [12]. In that study, we collected coral samples (*Porites lobata*) approximately 75 d after the spill, and we assayed a suite of biomarkers, including many of those investigated during the present study. Among biomarkers of xenobiotics response, we noted that all the biomarkers that were elevated in the present study (e.g., CYP 450 1-class, CYP 450 2-class, MXR-1, and GST-pi) also were elevated in corals collected at Yap approximately 75 d after the oil spill. We also noted that CYP 450 6-class was not elevated in our present study, and the results were equivocal in the corals collected from the impacted site at Yap. The CYP 450 6-class levels were not significantly different from those expressed by corals at one of the reference sites. Again, this is not surprising, in that CYP 450 6-class interacts with the chlorinated side chains of pesticides [32,33]. It was expected that the level of expression of the various biomarkers (e.g., CYP 450 1-class) would vary between our field [12] and laboratory studies. Such differences likely result from interspecific variation, duration of exposure, laboratory versus environmental conditions, and so on. Finally, the narrow range of biomarkers examined in the present study was informed by the results from the field study and was adequate to demonstrate the impact of oil on corals under laboratory conditions.

Likewise, PPO levels did not differ significantly from control samples in our laboratory study, and the levels were not elevated among impacted corals in Yap when compared to corals collected from two reference sites. However, levels of FC and HO-1 were significantly elevated in exposed corals in both studies. Thus, porphyrin metabolism appears to be affected in a similar manner in both situations.

Our comparative evaluation of oxidative damage and response exhibited a remarkable similarity to our observation of xenobiotic response. In fact, MutY was elevated in both laboratory-exposed corals and in situ–exposed corals. However, levels of Cu/ZnSOD produced somewhat ambiguous results in the laboratory, because control samples did not differ significantly in corals from high and low exposure concentrations but did differ significantly from the intermediate exposure level. In the field study, we observed similar ambiguity, because the elevations observed in the exposed corals only differed significantly from one of the two reference sites utilized. The low number of samples and inherent variability of the data likely limited our ability to detect significant differences.

Finally, levels of two key protein chaperones, Hsp70 and sHsp, were elevated in both exposure situations compared to levels in the control/reference corals. Again, these results also demonstrate a remarkable similarity between independent laboratory and field studies.

These results clearly demonstrate the utility of this approach across the two coral species. Specifically, it is of considerable significance that almost without exception, we observed a parallel response in two different species of corals to laboratory and in situ oil exposures for a variety of biomarkers, the obvious implication being that biomarkers and, in particular, suites of biomarkers have the potential to accurately predict toxic insults in coral reef ecosystems.

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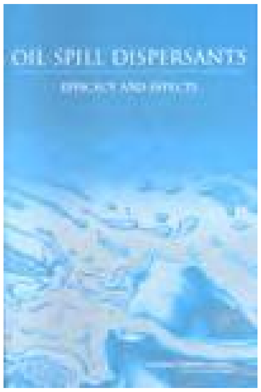
REFERENCES

1. Scheffer M, Carpenter S, Foley JA, Folke C, Walker B. 2001. Catastrophic shifts in ecosystems. *Nature* 413:591–596.
2. Bellwood DR, Hughes TP, Folke C, Nystrom M. 2004. Confronting the coral reef crisis. *Nature* 429:827–833.
3. Anderson CM, LaBelle RP. 2000. Update of comparative occurrence rates for offshore oil spills. *Spill Science and Technology Bulletin* 6:303–321.
4. Da Cunha PL, Antunes MM. 1999. Occurrence of vertebral deformities in Gobiidae (Pisces) from the Tagus estuary. *Aquat Ecol* 33:281–285.
5. Savvaitova KA, Chebotarev YV, Pichugin MY, Maksimov SV. 1995. Anomalies in fish structure as indicators of the state of the environment. *Vopr Ikhtiol* 2:182–188.
6. Moiseenko TI. 2000. Morphophysiological rearrangements in fish organism in response to pollution (in the light of S.S. Shvart's theory). *Ehkologiya* 31:463–472.
7. Moiseenko TI. 2002. Change in the life-cycle strategy of fish under the effect of chronic water pollution. *Ehkologiya* 33:45–55.
8. Ostrander GK, Landolt ML, Kocan RM. 1988. The ontogeny of coho salmon (*Oncorhynchus kisutch*) behavior following embryonic exposure to benzo[*a*]pyrene. *Aquat Toxicol* 13:325–346.
9. Ostrander GK, Landolt ML, Kocan RM. 1989. Life history study of coho salmon (*Oncorhynchus kisutch*) following embryonic exposure to benzo[*a*]pyrene. *Aquat Toxicol* 15:109–126.
10. Sherwood MJ. 1977. Distribution of neoplasms and other diseases in marine fishes relative to the discharge of waste water. *Ann N Y Acad Sci* 298:210–224.
11. Bresler V, Bissinger V, Abelson A, Dizer H, Sturm A, Kratke R, Fishelson L, Hansen P-D. 1999. Marine mollusks and fish as biomarkers of pollution stress in littoral regions of the Red Sea, Mediterranean Sea, and North Sea. *Helgol Mar Res* 53:219–243.
12. Downs CA, Richmond RH, Mendiola WC, Rougée L, Ostrander GK. 2006. Cellular-physiological effects of the *MV Kyowa Violet* fuel-oil spill on the hard coral. *Porites lobata*. *Environ Toxicol Chem* 25:3171–3180.
13. Blenkisopp S, Boileau P, Kyle D, Sergy GA, Fingas MF. 1996. How to prepare water accommodated fractions from petroleum hydrocarbons for use in aquatic toxicity testing—The basics. *Proceedings*, 19th Arctic and Marine Oil Spill Program Technical Seminar, Environment Canada, Calgary, AB, September 4–10, 1995, pp 515–528.
14. Barron MG. 2003. Critical evaluation of CROSERF test methods for oil dispersant toxicity testing under sub-Arctic conditions. Contract 955.03.2. Final Report. Prince William Sound Regional Citizens' Advisory Council, Anchorage, AK, USA.
15. Pelletier MC, Burgess RM, Ho KT, Kuhn A, McKinney RA, Ryba SA. 1997. Phototoxicity of individual polycyclic aromatic hydrocarbons and petroleum to marine invertebrate larvae and juveniles. *Environ Toxicol Chem* 16:2190–2199.
16. Downs CA, Fauth JE, Robinson CE, Curry R, Lanzendorf B, Halas JC, Halas J, Woodley CM. 2005. Cellular diagnostics and coral health: Declining coral health in the Florida Keys. *Mar Pollut Bull* 51:558–569.
17. Ghosh S, Gepstein S, Heikkila JJ, Dumbroff EB. 1988. Use of scanning densitometer or an ELISA plate reader for measurement of nanogram amounts of protein in crude extracts from biological tissue. *Anal Biochem* 169:227–233.
18. Downs CA, Woodley CM, Richmond RH, Lanning LL, Owen R. 2005. Shifting the paradigm for coral reef 'health' assessment. *Mar Pollut Bull* 51:486–494.
19. Schagger H, von Jagow G. 1987. Tricine–sodium dodecyl sulfate–polyacrylamide gel electrophoresis for the separation of proteins in the range from 1 to 100 kDa. *Anal Biochem* 166:368–379.
20. Ploug M, Jensen AL, Barkholt V. 1989. Determination of amino acid compositions and NH_2-terminal sequences of peptides electroblotted onto PVDF membranes from tricine–sodium dodecyl sulfate–polyacrylamide gel electrophoresis: Application to peptide mapping of human complement component C3. *Anal Biochem* 181:33–39.
21. Mozdzanowski J, Hembach P, Speicher DW. 1992. High-yield electroblotting onto polyvinylidene difluoride membranes from polyacrylamide gels. *Electrophoresis* 13:59–64.
22. Crowther JR. 2001. *The ELISA Guidebook.* Humana, Totowa, NJ, USA.
23. Sokal RR, Rohlf FJ. 1995. *Biometry: The Principles and Practice of Statistics in Biological Research,* 3rd ed. W.H. Freeman, New York, NY, USA.
24. Domart-Coulon IJ, Traylor-Knowles N, Peters E, Elbert D, Downs CA, Price K, Stubbs J, McLaughlin S, Cox E, Aeby G, Brown PR, Ostrander GK. 2006. Comprehensive characterization of skeletal tissue growth anomalies of the finger coral *Porites compressa*. *Coral Reefs* 24:In press.
25. Norton NW, Mattie DR, Kearns CL. 1985. The cytopathologic effects of specific aromatic hydrocarbons. *Am J Pathol* 118:387–397.
26. Allen TFH, Starr T. 1982. *Hierarchy: Perspectives for Ecological Complexity.* University of Chicago Press, Chicago, IL, USA.
27. Guengerich PF. 2000. Pharmacogenomics of cytochrome P450 and other enzymes involved in biotransformation of xenobiotics. *Drug Dev Res* 49:4–16.
28. Leguen I, Carlsson C, Perdu-Durand E, Prunet P, Part P, Cravedi JP. 2000. Xenobiotic and steroid biotransformation activities in rainbow trout gill epithelial cells in culture. *Aquac Toxicol* 48:165–176.
29. Jokanović M. 2001. Biotransformation of organophosphorous compounds. *Toxicology* 166:139–160.
30. Synder MJ, Mulder EP. 2001. Environmental endocrine disruption in decapod crustacean larvae: Hormone titers, cytochrome P450, and stress protein responses to heptachlor exposure. *Aquat Toxicol* 55:177–190.
31. Gonzalez FJ. 2005. Role of cytochrome P450s in chemical toxicity and oxidative stress: Studies with CYP2E1. *Mutat Res* 569:101–110.
32. Dunkov BC, Guzov VM. 1997. The Drosophila cytochrome P450 gene Cyp6a2: Structure, localization, heterologous expression, and induction by phenobarbital. *DNA Cell Biol* 11:1345–1356.
33. Scott JG. 1999. Cytochrome P450s and insecticide resistance. *Insect Biochem Mol Biol* 29:757–777.
34. Sheehan D, Power A. 1999. Effects of seasonality on xenobiotic and antioxidant defense mechanisms of bivalve mollusks. *Comp Biochem Physiol C Toxicol Pharmacol* 123:193–199.
35. Habig WH, Pabst MJ, Jakoby WB. 1974. Glutathione-*S*-transferases. The first enzymatic step in mercapturic acid formation. *J Biol Chem* 249:7130–7139.
36. Bard SM. 2000. Multixenobiotic resistance as a cellular defense mechanism in aquatic organisms. *Aquat Toxicol* 48:357–389.
37. Eaton DL, Bammler TK. 1999. Concise review of the glutathione-*S*-transferases and their significance to toxicology. *Toxicol Sci* 49:156–164.
38. Borst P, Elferink RO. 2002. Mammalian ABC transporters in health and disease. *Ann Rev Biochem* 71:537–592.
39. DiPietro A, Conseil G. 2002. Modulation of flavonoids of cell multidrug resistance mediated by P-glycoprotein and related ABC transporters. *Cell Mol Life Sci* 59:307–322.
40. Poulson R, Polglase JW. 1975. The enzymatic conversion of protoporphyrinogen IX to protoporphyrin IX. *J Biol Chem* 250:1269–1274.
41. Frustaci JM, O'Brain MR. 1993. The *Escherichia coli visA* Encodes Ferrochelatase, the final enzyme of the heme biosynthetic pathway. *J Bacteriol* 175:2154–2156.
42. Marks GS. 1985. Exposure to toxic agents: The heme biosynthetic pathway and hemoproteins as indicator. *Crit Rev Toxicol* 15:151–179.
43. Hwang C, Rhie G. 2002. Copper- and zinc-containing superoxide dismutase (Cu/ZnSOD) is required for the protection of *Candida albicans* against oxidative stresses and the expression of its full virulence. *Microbiology* 148:3705–3713.
44. Fujs S, Gazdag Z, Poljšak B, Stibilj V, Milačič, Pesti M, Raspor P, Batič M. 2005. The oxidative stress response of the yeast *Candida intermedia* to copper, zinc, and selenium exposure. *J Basic Microbiol* 45:125–135.
45. Croitoru ME, Cleary SP. 2004. Association between biallelic and monoallelic germline MYH gene mutations and colorectal cancer risk. *J Natl Cancer Inst* 96:1631–1634.
46. Tom M, Douek J. 1999. Molecular characterization of the first heat shock protein 70 from a reef coral. *Biochem Biophys Res Commun* 262:103–108.



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References

Aamo, O.M., M. Reed and P. Daling. 1993. A laboratory based weathering model: PC version for coupling to transport models. Pp. 617–626 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Canada. Environment Canada, Ottawa, Ontario, Canada.

Aamo, O.M., M. Reed and K. Downing. 1997. Oil Spill Contingency and Response (OSCAR) Model System: Sensitivity Studies. Pp. 429–438 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

Adams, G.G., P.L. Klerks, S.E. Belanger and D. Dantin. 1999. The Effect of the Oil Dispersant Omni-Clean on the Toxicity of Fuel Oil No. 2 in Two Bioassays With the Sheepshead Minnow *Cypriodon variegates*. *Chemosphere* 39:2141–2157.

Addassi, Y.M. Sowby, H. Parker-Hall and W. Robberson. In press. Establishment of Dispersant Use Zones in the State of California: A consensus approach for marine waters 200 nautical miles from shore. *Proceedings of the 2005 International Oil Spill Conference*, Miami Beach, Florida. American Petroleum Institute, Washington, D.C.

Agrawal, Y.C., E.A. Terray, M.A. Donelan, P.A. Hwang, A.J. Williams, W.M. Drennan, K.K. Kahma and S.A. Kitaigorodskii. 1992. Enhanced dissipation of kinetic energy beneath surface waves. *Nature* 359:219–220.

Alaska Department of Environmental Conservation. 1989. Letter dated March 28, 1989 from the State of Alaska to the U.S. Coast Guard. State of Alaska, Department of Environmental Conservation, Office of the Commissioner, Juneau.

Alaska Department of Environmental Conservation. 1993. *The Exxon Valdez Oil Spill: Final Report State of Alaska Response.* State of Alaska, Department of Environmental Conservation, Office of the Commissioner, Juneau.

Alaska Oil Spill Commission. 1990. *The Wreck of the Exxon Valdez.* Final report of the State of Alaska Oil Spill Commission. State of Alaska, Office of the Governor, Juneau.

Allen, A.A. 1988. Comparison of response options for offshore oil spills. Pp. 289–306 in *Proceedings of the Eleventh Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Allen, A.A. and J.R. Payne. 2001. *Liverpool Bay crude oil discharge tests at OHMSETT Facilities—December 2–6, 2000.* A report prepared for BHP Petroleum Limited, Spiltec, and Payne Environmental Consultants, Incorporated. Payne Environmental Consultants, Incorporated, Encinitas, California.

American Society of Civil Engineers (ASCE) Task Committee on Modeling of Oil Spills of the Water Resources Engineering Division. 1996. State-of-the Art Review of Modeling Transport and Fate of Oil Spills. *Journal of Hydraulic Engineering* 122(11):594–609.

American Society for Testing and Materials (ASTM). 1992. *Standard Guide for Oil Spill Dispersant Application Equipment: Boom and Nozzle Systems.* Designation: F1413-92. American Society for Testing and Materials, Philadelphia, Pennsylvania.

American Society for Testing and Materials (ASTM). 1993. *Standard Practice for Calibrating Oil Spill Dispersant Application Equipment: Boom and Nozzle Systems.* Designation: F1460-93. American Society for Testing and Materials, Philadelphia, Pennsylvania.

American Society for Testing and Materials (ASTM). 1996. *Standard Guide for Use of Oil Spill Dispersant Application Equipment During Spill Response: Boom and Nozzle Systems.* Designation: F1737-96. American Society for Testing and Materials, Philadelphia, Pennsylvania.

American Society for Testing and Materials (ASTM). 2000. *Standard Test Method for Laboratory Oil Spill Dispersant Effectiveness Using the Swirling Flask.* Designation: F2059-00. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Ankley, G.T., S.A. Collyard, P.D. Monson and P.A. Kosian. 1994. Influence of ultraviolet light on the toxicity of sediments contaminated with polycyclic aromatic hydrocarbons. *Journal of Environmental Toxicology and Chemistry* 13:1791–1796.

Aquatic Testing Laboratories. 1994. *Abalone larval development short term toxicity test for oil spill cleanup agents.* Laboratory report. Aquatic Testing Laboratories, Ventura, California.

Aunaas, T., A. Olsen and K.E. Zachariassen. 1991. The effects of oil and oil dispersants on the amphipod *Gammarus-oceanicus* from arctic waters. *Polar Research* 10(2)619–630.

Aurand, D., G. Coelho, J. Clark and G. Bragin. 1999. Goals, objectives and design of a mesocosm experiment on the environmental consequences of nearshore dispersant use. Pp. 629–643 in *Proceedings of the Twenty-Second Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Calgary, Canada. Environment Canada, Ottawa, Ontario, Canada.

Aurand, D., L. Walko and R. Pond. 2000. *Developing Consensus Ecological Risk Assessments: Environmental Protection in Oil Spill Response Planning A Guidebook.* United States Coast Guard. Washington, D.C.

Aurand, D.V., G.M. Coelho and A. Steen. 2001. Ten years of research by the U.S. oil industry to evaluate the ecological issues of dispersant use: An overview of the past decade. Pp. 429–434 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Aurand, D., M. Hitchings, L. Walko, J. Clark, J. Bonner, C. Page, R. Jamail and R. Martin. 2001. *Justification for the Proposed Texas General Land Office "Spill of Opportunity" Testing Program.* EM&A Preliminary Report 01-08A. Ecosystem Management & Associates, Incorporated, Lusby, Maryland.

Aurand, D., M. Hitchings, L. Walko, J. Clark, J. Bonner, C. Page, R. Jamail and R. Martin. 2004. *Texas General Land Office "Spill of Opportunity" Dispersant Demonstration Project Description.* EM&A Final Report 01-08A. Ecosystem Management & Associates, Incorporated, Lusby, Maryland.

Baca, B.J. and C.D. Getter. 1984. The toxicity of oil and chemically dispersed oil to the seagrass *Thalassia testudinum*. Pp. 314–323 in *Oil Spill Chemical Dispersants: Research, Experience, and Recommendations*, T.E. Allen, Ed. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Baker, J.M., J.H. Cruthers, D.I. Little, J.H. Oldham and C.M. Wilson. 1984. Comparison of the fate and ecological effects of dispersed and non-dispersed oil in a variety of marine habitats. Pp. 239–279 in *Oil Spill Chemical Dispersants: Research, Experience, and Recommendations*, T.E. Allen, ed. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Ballou, T.G., R.E. Dodge, S.C. Hess, A.H. Knap and T.D. Sleeter. 1987. *Effects of a Dispersed and Undispersed Crude Oil on Mangroves, Seagrasses, and Corals.* American Petroleum Institute Publication Number 4460. American Petroleum Institute, Washington, D.C.

Ballou, T.G., S.C. Hess, R.E. Dodge, A.H. Knap and T.D. Sleeter. 1989. Effects of untreated and chemically dispersed oil on tropical marine communities: A long-term field experiment. Pp. 447–454 in *Proceedings of the 1989 International Oil Spill Conference*, San Antonio, Texas. American Petroleum Institute, Washington, D.C.

Barnea, N. and R. Laferriere. 1999. SMART: Scientific monitoring of advanced response technologies. Pp.1265–1267 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Barron, M.G. 2000. *Potential for photenhanced toxicity of spilled oil in Prince William Sound and Gulf of Alaska waters.* Contract No. 602.00.1. Report prepared for the Prince William Sound Regional Citizen's Advisory Council. Prince William Sound Regional Citizens' Advisory Council, Anchorage, Alaska.

Barron, M.G. and L. Ka'aihue. 2001. Potential for photoenhanced toxicity of spilled oil in Prince William Sound and Gulf of Alaska waters. *Marine Pollution Bulletin* 43:86–92.

Barron, M.G. and L. Ka'aihue. 2003. Critical evaluation of CROSERF test methods for oil dispersant toxicity testing under subarctic conditions. *Marine Pollution Bulletin* 46:1191–1199.

Barron, M.G., T. Podrabasky, S. Ogle and R.W. Ricker. 1999. Are aromatic hydrocarbons the primary determinant of petroleum toxicity to aquatic organisms? *Aquatic Toxicology* 46:253–268.

Barron M.G., M.G. Carls, R. Heintz and S.D. Rice. 2004. Evaluation of fish early life stage toxicity models of chronic embryonic exposures to complex polycyclic aromatic hydrocarbon mixtures. *Toxicological Sciences* 78:60–67.

Bassin, N.J. and T. Ichiye. 1977. Flocculation behavior of suspended sediments and oil emulsions. *Journal of Sedimentary Petrology* 47:671–677.

Beaupoil, C. and D. Nedelec. 1994. *Etude de la toxicite du produit de lavage Corexit® 9500 vis-a-vis de la crevette blanche Palaemonetes varians.* Laboratoire de Biologie Marine, Concarneau, France.

Becker, K.W., M.A. Walsh, R.J. Fiocco and M.T. Curran. 1993. A new laboratory method for evaluating oil spill dispersants. Pp. 507–510 in *Proceedings of the 1993 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Belk, J.L., D.J. Elliott and L.M. Flaherty. 1989. The comparative effectiveness of dispersants in fresh and low salinity waters. Pp. 333–336 in *Proceedings of the 1989 International Oil Spill Conference*, San Antonio, Texas. American Petroleum Institute, Washington, D.C.

Belluck, D. 1993. Defining Scientific Procedural Standards for Ecological Risk Assessment. Pp. 440–450 in *Environmental Toxicology and Risk Assessment: 2nd Volume*, ASTM STP 1216, J.W. Gorsuch, F.J. Dwyer, C.G. Ingersoll and T.W. LaPoint, eds., American Society for Testing and Materials, Philadelphia, Pennsylvania.

Belore, R. 2003. Large wave tank dispersant effectiveness testing in cold water. Pp. 381–385 in *Proceedings of the 2003 International Oil Spill Conference*, Vancouver, Canada. American Petroleum Institute, Washington, D.C. [Online] Available at: http://www.slross.com/publications/IOSC.htm [February 11, 2005].

Berger, D. and D. Mackay. 1994. The evaporation of viscous or waxy oils—When is a liquid-phase resistance significant? Pp. 77–92 in *Proceedings of the Seventeenth Arctic and Marine*

Oil Spill Program (AMOP) Technical Seminar, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Bertuccioli, L., G.I. Roth, J. Katz, and T.R. Osborn. 1999. Turbulence measurements in the bottom boundary layer using particle image velocimetry. *Journal of Atmospheric and Oceanic Technology* 16(11):1635–1646.

Bhattacharyya, S., P.L. Klerks and J.A. Nyman. 2003. Toxicity to freshwater organisms from oils and oil spill chemical treatments in laboratory microcosms. *Environmental Pollution* 122:205–215.

Bhosle, N.B. and S. Mavinkurve. 1984. Effects of dispersants on microbial growth and biodegradation of crude oil. *Mahasagar-Bulletin of the National Institute of Oceanography* 17(4):233–238.

Bhosle, N.B. and A. Row. 1983. Effect of dispersants on the growth of indigenous bacterial population and biodegradation of crude oil. *Indian Journal of Marine Sciences* 12(3):194–196.

Blackall, P.J. and G.A. Sergy, 1981. The BIOS project-frontier oil spill countermeasures research. Pp. 167–172 in *Proceedings of the 1981 International Oil Spill Conference*, Atlanta, Georgia. American Petroleum Institute, Washington, D.C.

Blondina, G.J., M.L. Sowby, M.T. Ouano, M.M. Singer and R.S. Tjeerdema. 1997. A modified swirling flask efficacy test for oil spill dispersants. *Spill Science and Technology Bulletin* 4(3):177–185.

Blondina, G.J., M.M. Singer, I. Lee, M.T. Ouano, M. Hodgins, R.S. Tjeerdema and M.L. Sowby. 1999. Influence of salinity on petroleum accommodation by dispersants. *Spill Science and Technology Bulletin* 5(2):127–134.

Blum, D.J. and R.E. Speece. 1990. Determining chemical toxicity to aquatic species, *Environmental Science and Technology* 24:284–293.

Blumer, M., G. Souza and J. Sass. 1970. Hydrocarbon pollution of edible shellfish by an oil spill. *Marine Biology* 5:195–202.

Bobra, M. 1990. A study of the formation of water-in-oil emulsions. Pp. 87–117 in *Proceedings of the Thirteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Bobra, M. 1991. Water-in-Oil Emulsification: A Physicochemical Study. Pp. 483–492 in *Proceedings of the 1991 International Oil Spill Conference*, San Diego, California. American Petroleum Institute, Washington, D.C.

Bobra, M. 1992. *A Study of the Evaporation of Petroleum Oils.* Report No. EE-135. Report to Environmental Emergencies Science Division of Environment Canada. Environment Canada, Ottawa, Ontario, Canada.

Bocard, C., G. Castaing, J. Ducreux, C. Gatellier, J. Croquette and F. Merlin. 1987. PROTECMAR: The French experience form a seven-year dispersant offshore trials programme. Pp. 225–229 in *Proceedings of the 1987 International Oil Spill Conference*, Baltimore, Maryland. American Petroleum Institute, Washington, D.C.

Boehm, P.D. 1987. Transport and Transformation Processes Regarding Hydrocarbon and Metal Pollutants in Offshore Sedimentary Environments. Pp. 233–287 in *Long-Term Environmental Effects of Offshore Oil and Gas Development*, D.F. Boesch and N.N. Rabalais, eds. Elsevier Applied Science, New York, New York.

Boehm, P.D. and D.L. Fiest. 1980. Surface water column transport and weathering of petroleum hydrocarbons during the IXTOC-I blowout in the Bay of Campeche and their relation to surface oil and microlayer compositions. Pp. 267–338 in *Proceedings of the Symposium on Preliminary Results from the September 1979 Researcher/Pierce IXTOC-I Cruise*, Key Biscayne, Florida. National Oceanic and Atmospheric Administration Publications Office, Boulder, Colorado.

Boehm, P.D. and D.L. Fiest. 1982. Subsurface distribution of petroleum from an offshore well blowout. The IXTOC-I blowout, Bay of Campeche. *Environmental Science and Technology* 16(2):67–74.

Boese, B.L., J.O. Lamberson, R.C. Swartz and R.J. Ozretich. 1997. Photoinduced toxicity of fluoranthene to seven marine benthic crustaceans. *Archives of Environmental Contamination and Toxicology* 32:389–393.

Bonner, J.S., C.A. Page and C.B. Fuller. 2003. Meso-scale testing and development of test procedures to maintain mass balance. *Marine Pollution Bulletin* 47:406–414.

Box, G.E.P., W.G. Hunter and J.S. Hunter. 1978. *Statistics for Experimenters: An Introduction to Design, Data Analysis, and Model Building*. John Wiley & Sons, Incorporated, New York, New York.

Bradbury, S., R.Carlson and T. Henry. 1989. Polar narcosis in aquatic organisms. *Aquatic Toxicology and Hazard Assessment* 12:59–73.

Braddock, J.F. and Z.D. Richter. 1998. *Microbial degradation of aromatic hydrocarbons in marine sediments.* Final Report OCS Study MMS 97-0041. Institute of Arctic Biology, University of Alaska, Fairbanks.

Bragg, J.R. and E.H. Owens. 1994. Clay-oil flocculation as a natural cleansing process following oil spills: Part 1—Studies of shoreline sediments and residues from past spills. Pp. 1–23 in *Proceedings of the Seventeenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Bragg, J.R. and E.H. Owens. 1995. Shoreline cleansing by interactions between oil and fine mineral particles. Pp. 216–227 in *Proceedings of the 1995 International Oil Spill Conference*, Long Beach, California. American Petroleum Institute, Washington, D.C.

Bragg, J.R. and S.H. Yang. 1995. Clay–oil flocculation and its effects on the rate of natural cleansing in Prince William Sound following the Exxon Valdez oil spill. Pp. 178–214 in *Exxon Valdez Oil Spill—Fate and Effects in Alaskan Waters*, P.G. Wells, J.N. Butler, J.S. Hughes eds., American Society for Testing and Materials, Philadelphia, Pennsylvania.

Bragin, G., G. Coelho, E. Febbo, J. Clark and D. Aurand. 1999. Coastal oilspill simulation system comparison of oil and chemically dispersed oil released in near-shore environments: Biological effects. Pp. 671–683 in *Proceedings of the Twenty-Second Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Brandvik, J.J. and P.S. Daling. 1990. Statistical experimental design optimization of dispersant's performance. Pp. 243–254 in *Proceedings of the Thirteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Brandvik, J.J., P.S. Daling and K. Aareskjold. 1991. *Chemical dispersibility testing of fresh and weathered oils—an extended study with eight oil types.* DIWO Report No. 12. SINTEF Group, Trondheim, Norway.

Brandvik, J.J., M.D. Moldestad and P.S. Daling. 1992. Laboratory testing of dispersants under arctic conditions. Pp. 123–134 in *Proceedings of the Fifteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Brandvik, J.J., P.S. Daling, A. Lewis and T. Lunel. 1995. Measurements of dispersed oil concentrations by *in-situ* UV fluorescence during the Norwegian experimental oil spill with Sture blend. Pp. 519–535 in *Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Brandvik, P.J., T. Strom-Kristiansen, A. Lewis, P.S. Daling, M. Reed, H. Rye and H. Jensen. 1996. The Norwegian Sea trial 1995 offshore testing of two dispersant systems in simu-

lation of an underwater pipeline leakage, a summary paper. Pp. 1395–1416 in *Proceedings of the Nineteen Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Briceno, J., W.J. McKee, J.R. Clark and D.D. Whiting. 1992. *Relative sensitivity of Gulf of Mexico species and national test species in acute toxicity tests with dispersants. Poster presentation.* Paper presented at the Thirteenth Annual Meeting of the Society of Environmental Toxicology and Chemisty (SETAC). SETAC, North America, Pensacola, Florida.

Bridie, A.L, Th.H. Wanders, W. Zegveld and H.B. Van der Heijde. 1980a. *The Formation, Prevention and Breaking of Sea-Water-in-Crude-Oil Emulsions: "Chocolate Mousse."* Paper presented at International Research Symposium, Chemical Dispersion of Oil Spills, Toronto, Canada. University of Toronto, Institute for Environmental Studies, Toronto, Ontario, Canada.

Bridie, A.L., Th.H. Wanders, W. Zegveld and H.B. Van der Heijde. 1980b. Formation, Prevention and Breaking of Sea Water in Crude Oil Emulsions: "Chocolate Mousses." *Marine Pollution Bulletin* 2:343–348.

Briggs, K.T., S.H. Yoshida and M.E. Gershwin. 1996. The influence of petrochemicals and stress on the immune system of seabirds. *Regulatory Toxicology and Pharmacology* 23:145–155.

Brochu, C., E. Pelletier, G. Caron and J.E. Desnoyers. 1986. Dispersion of crude oil in seawater: The role of synthetic surfactants. *Oil & Chemical Pollution* 3:257–279.

Broecker, W.S. and T.-H. Peng. 1982. *Tracers in the Sea.* Lamont-Doherty Geological Observatory, Palisades, New York.

Brooks, J.M., D.A. Weisenburg, R.A. Burke, M.C. Kenicutt and B.B. Bernard. 1980. Gaseous and volatile hydrocarbons in the Gulf of Mexico following the IXTOC-I blowout. Pp. 53–88 in *Proceedings of the Symposium on Preliminary Results from the September 1979 Researcher/Pierce IXTOC-I Cruise*, Key Biscayne, Florida. National Oceanic and Atmospheric Administration Publications Office, Boulder, Colorado.

Brovchenko, I., A. Kuschan, V. Maderich, M. Shlakhtun, V. Koshebutsky and M. Zheleznyak. 2003. Model of oil spill simulation in the Black Sea. Pp. 101–112 in *Proceedings of the Third Conference on Oil Spills, Oil Pollution and Remediation*, Istanbul, Turkey. Bo-aziçi University, Institute of Environmental Sciences, Istanbul, Turkey.

Brown, C.E., M.F. Fingas, R.H. Goodman, J.V. Mullin, M. Choquet and J.-P. Monchalin. 2000. Progress in achieving airborne oil slick thickness measurement. Pp. 493–498 *Proceedings of the Twenty-Third Arctic and Marine Oil Spill Program (AMOP)* Technical Seminar, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Brown, H.M. and R.H. Goodman. 1987. *The Dispersion of Alaska North Slope Oil in Wave Basin Tests.* Report to Alaska Clean Seas and Esso Imperial Oil. Alaska Clean Seas, Prudhoe Bay, Alaska, and Esso Imperial Oil, Calgary, Alberta, Canada.

Brown, H.M. and R.H. Goodman. 1988. Dispersant tests in a wave basin—four years of experience. Pp. 501–514 in *Proceedings of the Eleventh Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Brown, H.M., R.H. Goodman and G.P. Canevari. 1987. Where has all the oil gone? Dispersed oil detection in a wave basin and at sea. Pp. 307–312 in *Proceedings of the 1987 International Oil Spill Conference*, Baltimore, Maryland. American Petroleum Institute, Washington, D.C.

Brown, H.M., J.S. Goudey, J.M. Foght, S.K. Cheng, M. Dale, J. Hoddinott, L.R. Quaife and D.W.S. Westlake. 1990. Dispersion of spilled oil in freshwater systems: field trial of a chemical dispersant. *Oil and Chemical Pollution* 6:37–54.

Bruheim, P. and K. Eimhjellen. 2000. Effects of non-ionic surfactants on the uptake and hydrolysis of fluorescein diacetate by alkane-oxidizing bacteria. *Canadian Journal of Microbiology* 46(4):387–390.

Bruheim, P., H. Bredholt and K. Eimhjellen. 1997. Bacterial degradation of emulsified crude oil and the effect of various surfactants. *Canadian Journal of Microbiology* 43:17–22.

Bruheim, P., H. Bredholt and K. Eimhjellen. 1999. Effects of surfactant mixtures, including Corexit 9527, on bacterial oxidation of acetate and alkanes in crude oil. *Applied and Environmental Microbiology* 65(4):1658–1661.

Burbank, D.C. 1977. *Environmental studies of Kachemak Bay and lower Cook Inlet—Volume III. Circulation studies in Kachemak Bay and lower Cook Inlet.* Alaska Department of Fish and Game, Anchorage, Alaska.

Burns, K.A. and A.H Knap. 1989. The Bahia Las Minas oil spill: Hydrocarbon uptake by reef building corals. *Marine Pollution Bulletin* 20(8):391–398.

Burns, K.A., S. Codi, C. Pratt and N.C. Duke. 1999. Weathering of hydrocarbons in mangrove sediments: testing the effects of using dispersants to treat oil spills. *Organic Geochemistry* 30:1273–1286.

Burridge, T.R. and M. Shir. 1995. The comparative effects of oil, dispersants, and oil/dispersant conjugates on germination of marine macroalga *Phyllospora comosa* (Fucales: Phaeophyta). *Marine Pollution Bulletin* 31:446–452.

Bury, S.J. and C.A. Miller. 1993. Effect of micellar solubilization on biodegradation rates of hydrocarbons. *Environmental Science and Technology* 27:104–110.

Butler, J.N. 1975. Evaporative weathering of petroleum residues: the age of pelagic tar. *Marine Chemistry* 3:9–21.

Butler, J.N., B.F. Morris and T.D. Sleeter. 1976. The fate of petroleum in the open ocean. Pp. 287–297 in *Sources, effects, and sinks of hydrocarbons in the aquatic environment*. The American Institute of Biological Sciences, Washington, D.C.

Byford, D.C., P.J. Green and A. Lewis. 1983. Factors influencing the performance and selection of low-temperature dispersants. Pp. 140–150 in *Proceedings of the Sixth Annual Arctic Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Byford, D.C., P.R. Laskey and A. Lewis. 1984. Effect of low temperature and varying energy input on the droplet size distribution of oils treated with dispersants. Pp. 208–228 in *Proceedings of the Seventh Annual Arctic Marine Oilspill Program (AMOP) Technical Seminar*. Environment Canada. Ottawa, Ontario, Canada

Canevari, G.P. 1969. The role of chemical dispersants in oil cleanup. Pp. 29–51 in *Oil on the Sea*, D.P. Hoult, Ed. Plenum Press, New York, New York.

Canevari, G.P. 1984. A review of the relationship between the characteristics of spilled oil and dispersant effectiveness. Pp. 87–93 in *Oil Spill Chemical Dispersants: Research, Experience, and Recommendations*, T.E. Allen, Ed. American Society for Testing and Materials. Philadelphia, Pennsylvania.

Canevari, G.P., P. Calcavecchio, R.R. Lessard, K.W. Becker and R.J. Fiocco. 2001. Key parameters affecting the dispersion of viscous oil. Pp. 479–483 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Champ, M.A., ed. 2000. Special issue: Langmuir circulation and oil spill modeling. *Spill Science and Technology Bulletin* 6(3/4):207–275.

Chandrasekar, S., G. Sorial and J.W. Weaver. 2003. Determining dispersant effectiveness data for a suite of environmental conditions. *Proceedings of the 2003 International Oil Spill Conference*, Vancouver, Canada. American Petroleum Institute, Washington, D.C.

Choquet, M., R. Heon, G. Vaudreuil, J.-P. Monchalin, C. Padioleau and R.H. Goodman. 1993. Remote thickness measurement of oil slicks on water by laser-ultrasonics. Pp. 531–536 in *Proceedings of the 1993 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Chow, V.T. 1988. *Open Channel Hydraulics.* McGraw-Hill, Incorporated, New York, New York.

Churchill, P.F. and S.A. Churchill. 1997. Surfactant-enhanced biodegradation of solid alkanes. *Journal of Environmental Science and Health, A* 32(1):293–306.

Clark, J.R., G.E. Bragin, R.J. Febbo and D.J. Letinski. 2001. Toxicity of physically and chemically dispersed oils under continuous and environmentally realistic exposure conditions: Applicability to dispersant use decisions in spill response planning. Pp. 1249–1255 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Clayton, J.R., Jr., J.R. Payne and J.S. Farlow. 1993. *Oil Spill Dispersants: Mechanisms of Action and Laboratory Tests.* CRC Press, Incorporated, Boca Raton, Florida.

Cloutier, D., C.L. Amos, P.R. Hill and K. Lee. 2002. Oil erosion in an annular flume by seawater of varying turbidities: a critical bed shear stress approach. *Spill Science and Technology Bulletin* 8(1):83–93.

Coelho, G.M. and D.V. Aurand, Eds. 1996. *Proceedings of the Fifth Meeting of the Chemical Response to Oil Spills: Ecological Effects Research Forum.* Ecosystem Management and Associates, Purcellville, Virginia.

Coelho, G.M. and D.V. Aurand, Eds. 1997. *Proceedings of the Sixth Meeting of the Chemical Response to Oil Spills: Ecological Effects Research Forum.* Ecosystem Management and Associates, Purcellville, Virginia.

Coelho, G., D. Aurand and D.A. Wright. 1999. Biological uptake analysis of organisms exposed to oil and chemically dispersed oil. Pp. 685–694 in *Proceedings of the Twenty-Second Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Cohen, A.M. and D. Nugegoda. 2000. Toxicity of three oil spill remediation techniques to the Australian bass *Macquaria novemaculeata*. *Ecotoxicology and Environmental Safety* 47(2): 178–185.

Cohen, A.M., D. Nugegoda and M.M. Gagnon. 2001a. Metabolic Responses of Fish Following Exposure to Two Different Oil Spill Remediation Techniques. *Ecotoxicology and Environmental Safety* 48:306–310.

Cohen, A.M., D. Nugegoda and M.M. Gagnon. 2001b. The Effect of Different Oil Spill Remediation Techniques on Petroleum Hydrocarbon Elimination in Australian Bass (*Macquaria novemaculeata*). *Archives of Environmental Contamination and Toxicology* 40: 264–270.

Cohen, A., M.M. Gagnon and D. Nugegoda. 2003. Biliary PAH metabolite elimination in Australian bass, *Macquaria novemaculeata,* following exposure to bass straight crude oil and chemically dispersed crude oil. *Bulletin of Environmental Contamination and Toxicology* 70(2):394–400.

Conover, R.J. 1971. Some relations between zooplankton and Bunker C oil in Chedabucto Bay following the wreck of the tanker *Arrow*. *Journal of the Fisheries Research Board Canada* 28:1327–1330.

Cook, C.B. and A.H. Knap, 1983. The effects of crude oil and chemical dispersant on photosynthesis in the brain coral, *Diploria strigosa*. *Marine Biology* 78:21–27.

Cormack, D., B.W.J. Lynch and B.D. Dowsett. 1987. Evaluation of dispersant effectiveness. *Oil and Chemical Pollution* 3:87–103.

Coutou, E.I. Castritis-Catharios and M. Moraitou-Apostolopoulo. 2001. Surfactant-based oil dispersant toxicity to developing nauplii of Artemia: effects on ATPase enzymatic system. *Chemosphere* 42:959–964.

CRC. 1967. *CRC Handbook of Chemistry and Physics: A Ready-Reference Book of Chemical and Physical Data.* Forty-eighth edition. R.C. Weast and S.M Selby, eds. The Chemical Rubber Company, Cleveland, Ohio.

Crowell, M.J. and P.A. Lane. 1988. *The Effects of Crude Oil and the Dispersant Corexit 9527 on the Vegetation of a Nova Scotian Saltmarsh: Impacts After Two Growing Seasons.* Report no. EE-103, Environment Canada, Ottawa, Ontario, Canada.

Csanady, G.T. 1973. *Turbulent Diffusion in the Environment.* Reidel Publishing Company, Boston, Massachusetts.

Daling, P.S. 1988. A study of the chemical dispersibility of fresh and weathered crudes. Pp. 481–499 in *Proceedings of the Eleventh Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Daling, P.S. and P.J. Brandvik. 1989. *The effects of photolysis on oil slicks.* SINTEF Group, Trondheim, Norway.

Daling, P.S. and R. Lichtenthaler. 1987. Chemical dispersion of oil. Comparison of the effectiveness results obtained in laboratory and small-scale field tests. *Oil & Chemical Pollution* 3:87–103.

Daling, P.S., D. Mackay, N. Mackay and P.J. Brandvik. 1990a. Droplet size distributions in chemical dispersion of oil spills: towards a mathematical model. *Oil and Chemical Pollution* 7:173–198.

Daling, P.S., P.J. Brandvik, D. Mackay and O. Johansen. 1990b. Characterization of crude oils for environmental purposes. Pp. 119–138 in *Proceedings of the Thirteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Daling, P.S., O.M. Aamo, A. Lewis and T. Strom-Kritiansen. 1997. SINTEF/IKU Oil-Weathering Model: Predicting Oil's Properties at Sea. Pp. 297–307 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

Daling, P.S., P.J. Brandvik and M. Reed. 1998. *Dispersant experience in Norway: Dispersant effectiveness, monitoring, and fate of dispersed oil. Dispersant Application in Alaska: A Technical Update.* Prince William Sound Oil Spill Recovery Institute, Cordova, Alaska.

Dames and Moore. 1978. *Drilling fluid dispersion and biological effects study for the Lower Cook Inlet C.O.S.T. well.* Report prepared for the Atlantic Richfield Company. Dames and Moore Group, Los Angeles, California.

Davies, L., F. Daniel, R.P.J. Swannell and J.F. Braddock. 2001. *Biodegradability of chemically-dispersed oil.* A report prepared for the Minerals Management Service, Alaska Department of Environmental Conservation, and the United States Coast Guard. Minerals Management Service, Herndon, Virginia.

Delaune, R.A., C.J. Smith, W.H. Patrick, J.W. Fleeger and M.D. Tolley. 1984. Effect of oil on salt marsh biota: Methods for restoration. *Environmental Pollution* 36(3)207–227.

Delvigne, G.A.L. 2002. Physical appearance of oil in oil-contaminated sediment. *Spill Science and Technology Bulletin* 8(1)55–63.

Delvigne, G.A.L. and C.E. Sweeney. 1988. Natural dispersion of oil. *Oil and Chemical Pollution* 4:281–310.

Delvigne, G.A.L., J.A. Roelvink and C.E. Sweeney. 1986. Research on vertical turbulent dispersion of oil droplets and oiled particles—Literature review. OCS Study MMS 86-0029. Report to Minerals Management Service. Minerals Management Service, Anchorage, Alaska.

Delvigne, G.A.L., J.A.Van der Stel and C.E. Sweeney. 1987. *Measurements of vertical turbulent dispersion and diffusion of oil droplets and oiled particles.* OCS Study MMS 87-111. Minerals Management Service, Anchorage, Alaska.

Deneer, J.W., T. Sinnige, W. Seinen and J.L.M. Hermens. 1988. The joint acute toxicity to Daphnia magna of industrial organic chemicals at low concentrations. *Aquatic Toxicology* 12:33–38.

DiToro, D.M., C.S. Zarba, D.J. Hansen, W.J. Berry, R.C. Swartz, C.E. Cowan, S.P. Pavlou, H.E. Allen, N.A. Thomas and P.R. Paquin. 1991. Technical basis for establishing sediment quality criteria for nonionic organic chemicals using equilibrium partitioning. *Journal of Environmental Toxicology and Chemistry* 10:1541–1583.

DiToro, D.M., J.A. McGrath and D.J. Hansen. 2000. Technical basis for narcotic chemicals and polycyclic aromatic hydrocarbon criteria. I. Water and tissue. *Journal of Environmental Toxicology and Chemistry* 19:1951–1970.

Dodge, R.E., S.C. Wyers, H.R. Frith, A.H. Knap, S.R. Smith and T.D. Sleeter. 1984. Effects of oil and oil dispersants on the skeletal growth of the hermatypic coral *Diplora strigosa*. *Coral Reefs* 3(4):191–198.

Dodge, R.E., B.J. Baca, A.H. Knap, S.C. Snedaker and T.D. Sleeter. 1995. *The Effects of Oil and Chemically Dispersed Oil in Tropical Ecosystems: 10 Years of Monitoring Experimental Sites.* Technical Report Series 95-014. Marine Spill Response Corporation, Washington, D.C.

Doron, P., L. Bertuccioli, J. Katz and T.R. Osborn. 2001. Turbulence characteristics and dissipation estimates in the coastal ocean bottom boundary layer from PIV data. *Journal of Physical Oceanography* 31(8):2108–2134.

Duesterloh, W., J.W. Short and M.G. Barron. 2002. Photoenhanced toxicity of weathered Alaska North Slope crude oil to the calanoid copepods *Calanus marshallae* and *Metridia okhotensis*. *Environmental Science and Technology* 36:3953–3959.

Duke, N.C. and K.A. Burns. 1999. *Fate and effects of oil and dispersed oil on mangrove ecosystems in Australia.* Report to the Australian Petroleum Production Exploration Association. Australian Institute of Marine Science, Townsville, Queensland, Australia and CRC Reef Research Centre, James Cook University, Townsville, Queensland, Australia. [Online] Available at: http://www.aims.gov.au/pages/research/mangroves/fae/fae01.html [February 14, 2005].

Duke, N.C., Z.S. Pinzon and M.C. Prada T. 1997. Large-scale damage to mangrove forests following two large oil spills in Panama. *Biotropica* 29:2–14.

Duke, N.C., K.A. Burns and O. Dalhaus. 1998a. Effects of oils and dispersed-oils on mangrove seedlings in planthouse experiments: a preliminary assessment of results two months after oil treatments. *Australian Petroleum Production and Exploration Association Limited Journal* 38:631–636.

Duke, N.C., K.A. Burns, J.C. Ellison, R.J. Rupp and O. Dalhaus. 1998b. Effects of oil and dispersed-oil mixtures on mature mangroves in field trials at Gladstone. *Australian Petroleum Production and Exploration Association Limited Journal* 38:637–645.

Duke, N.C., J.C. Ellison and K.A. Burns. 1998c. Surveys of oil spill incidents affecting mangrove habitat in Australia: a preliminary assessment of incidents, impacts on mangroves, and recovery of deforested areas. *Australian Petroleum Production and Exploration Association Limited Journal* 38:646–654.

Duke, N.C., K.A. Burns and R.P.J. Swannell. 1999. *Research into the bioremediation of oil spills in tropical Australia: with particular emphasis on oiled mangrove and salt marsh habitat.* Final Report to the Australian Maritime Safety Authority. Australian Institute of Marine Science, Townsville, Queensland, Australia and AEA Technology, Oxfordshire, United Kingdom.

Duke, N.C., K.A. Burns, R.P.J. Swannell, O. Dalhaus and R.J. Rupp. 2000. Dispersant use and a bioremediation strategy as alternate means of reducing impacts of large oil spills on Mangroves: The Gladstone Field Trials. *Marine Pollution Bulletin* 41:7–12, 403–412.

Dutka, B.J. and K.K. Kwan. 1984. Study of long term effects of oil and oil-dispersant mixtures on freshwater microbial populations in man made ponds. *Science of the Total Environment* 35:135–148.

Duval, W.S., L.A. Harwood and R.P. Fink. 1982. *The sublethal effects of dispersed oil on an estuarine isopod.* Technology Development Report, EPS-4-EC-82-1. Environment Canada, Ottawa, Ontario, Canada.

Ecological Steering Group on the Oil Spill in Shetland. 1994. *The Environmental Impact of the Wreck of the Braer.* Scottish Office, Edinburgh, United Kingdom.

Eganhouse, R.P. and J.A. Calder. 1976. The solubility of medium molecular weight aromatic hydrocarbons and the effects of hydrocarbon co-solutes and salinity. *Geochimica et Cosmochimica Acta* 40:555–561.

Elliott, A.J., N. Hurford and C.J. Penn. 1986. Shear diffusion and the spreading of oil slicks. *Marine Pollution Bulletin* 17(7):308–313.

Environment Canada. 2005. *Oil Properties Database.* Environment Canada, Ottawa, Ontario, Canada. [Online] Available at: http://www.etcentre.org/databases/spills_e.html [April 18, 2005].

Environmental Protection Agency (EPA). 1992. *Peer Review Workshop Report on a Framework for Ecological Risk Assessment.* U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, D.C.

Environmental Protection Agency (EPA). 2001. *EPA requirements for quality assurance project plans.* EPA QA/R-5, EPA/240/B-01/003. U.S. Environmental Protection Agency, Office of Environmental Information, Washington D.C.

Environmental Protection Agency (EPA). 2002a. *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms.* EPA-821-R-02-013. U.S. Environmental Protection Agency, Washington D.C. [Online] Available at: http://www.epa.gov/waterscience/WET/disk3/ [April 27, 2005].

Environmental Protection Agency (EPA). 2002b. *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms.* EPA-821-R-02-012. U.S. Environmental Protection Agency, Washington D.C. [Online] Available at: http://www.epa.gov/waterscience/WET/disk2/ [April 27, 2005].

Environmental Protection Agency (EPA). 2003. Swirling flask dispersant effectiveness test. Pp. 224–229 in *Code of Federal Regulations Title 40: Protection of the Environment* (40 CFR). Pt. 300, Appendix C. Federal Register, Washington, D.C. [Online] Available at: http://www.epa.gov/epahome/cfr40.htm [March 23, 2005].

Environmental Protection Agency (EPA). 2005. *Terms of Environment.* Environmental Protection Agency, Washington, D.C. [Online] Available at: http://www.epa.gov/OCEPA terms/ [April 27, 2005].

Epstein, N., R.P.M. Bak and B. Rinkevich. 2000. Toxicity of third generation dispersants and dispersed Egyptian crude oil on Red Sea coral larvae. *Marine Pollution Bulletin* 40:497–503.

Etkin, D.S. 1999. *Oil spill dispersants: From technology to policy.* Cutter Information Corporation, Arlington, Massachusetts.

Exxon. 1992. *Exxon Oil Spill Response Manual.* Exxon Production Research Company, Houston, Texas.

Exxon Biomedical Sciences Incorporated. 1992. *Microtox® toxicity tests. Test material: Corexit 9527.* Technical report. ExxonMobile, East Millstone, New Jersey.

Exxon Biomedical Sciences Incorporated 1993a. *Mysid acute toxicity test. Flowthrough continuous exposure with* Mysidopsis bahia. *Test material: Corexit 9527.* Technical report. ExxonMobile, East Millstone, New Jersey.

Exxon Biomedical Sciences Incorporated. 1993b. *Mysid acute toxicity test. Continuous exposure with* Holmesimysis costata. *Test material: Corexit® 9527.* Technical report. ExxonMobile, East Millstone, New Jersey.

Exxon Biomedical Sciences Incorporated. 1993c. *Mysid acute toxicity test. Flowthrough continuous exposure with* Holmesimysis costata*. Test material: Corexit 9527.* Technical report. ExxonMobile, East Millstone, New Jersey.

Exxon Biomedical Sciences Incorporated. 1993d. *Fish acute toxicity test flow-through continuous exposure with* Menidia beryllina*. Test material: Corexit 9527.* Technical report. ExxonMobile, East Millstone, New Jersey.

ExxonMobil. 2000. *Dispersant Guidelines.* ExxonMobil Research and Engineering Company, Fairfax, Virginia.

Fannelop, T.K. and K. Sjoen. 1980. Hydrodynamics of underwater blowouts. *Norwegian Maritime Researh* 4:17–33.

Fay, J.A. 1969. The spread of oil slicks on a calm sea. Pp. 53–63 in *Oil on the Sea*, D.P. Hoult, ed. Plenum Press, New York, New York.

Fiest, D.L. and P.D. Boehm. 1980. Subsurface distributions of petroleum from an offshore well blowout, Bay of Campeche. Pp. 169–185 in *Symposium on Preliminary Results from the September 1979 Researcher/Pierce IXTOC I Cruise*. Key Biscayne, Florida. National Oceanic and Atmospheric Administration Publications Office, Boulder, Colorado.

Fingas, M. 1985. The effectiveness of oil spill dispersants. *Spill Technology Newsletter* 10(4-6):47–64.

Fingas, M. 1996. The evaporation of crude oil and petroleum products. Ph.D. Thesis, McGill University, Montreal, Canada.

Fingas, M. 1997. The evaporation of oil spills: Prediction of equations using distillation data. Pp. in 1–20 *Proceedings of the Twentieth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M. 1999a. The evaporation of oil spills: Development and implementation of new prediction methodology. Pp. 281–287 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Fingas, M. 1999b. *In-Situ* Burning of Oil Spills: A Historical Perspective. Pp. 55–65 in *Workshop Proceedings* In-Situ *Burning of Oil Spills*, New Orleans, Louisiana. NIST Special Publication 935. National Institute of Standards and Technology, Gaithersburg, Maryland.

Fingas, M. 2002a. *A review of literature related to oil spill dispersants especially relevant to Alaska.* Report prepared for the Prince William Sound Regional Citizens' Advisory Council. Prince William Sound Regional Citizens' Advisory Council, Anchorage, Alaska.

Fingas, M. 2002b. *A white paper on oil spill dispersant field testing.* Report prepared for the Prince William Sound Regional Citizens' Advisory Council. Prince William Sound Regional Citizens' Advisory Council, Anchorage, Alaska.

Fingas, M. 2003. *Review of monitoring protocols for dispersant effectiveness.* Report prepared for the Prince William Sound Regional Citizens' Advisory Council. Prince William Sound Regional Citizens' Advisory Council, Anchorage, Alaska.

Fingas, M. 2004a. Dispersant tank testing—A review of procedures and considerations. Pp. 1003–1016 in *Proceedings of the Twenty-Seventh Arctic Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M. 2004b. Energy and work input in laboratory vessels. Pp. 1–18 in *Proceedings of the Twenty-Seventh Arctic Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M. and B. Fieldhouse. 1994. Studies of water-in-oil emulsions and techniques to measure emulsion treating agents. Pp. 233–244 in *Proceedings of the Seventeenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M. and B. Fieldhouse. 2003. Studies of the formation process of water-in-oil emulsions. *Marine Pollution Bulletin* 47:369–396.

Fingas, M. and B. Fieldhouse. 2004a. Modeling of water-in-oil emulsions. Pp. 335–350 in *Proceedings of the Twenty-Seventh Arctic Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M. and B. Fieldhouse. 2004b. Formation of water-in-oil emulsions and application to oil spill modeling. *Journal of Hazardous Materials* 107:37–50.

Fingas, M. and L. Ka'aihue. 2004a. Weather windows for oil spill countermeasures. Pp. 881–955 in *Proceedings of the Twenty-Seventh Arctic Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M. and L. Ka'aihue. 2004b. Dispersant field testing—a review of procedures and considerations. Pp. 1017–1046 in *Proceedings of the Twenty-Seventh Arctic Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M. and L. Ka'aihue. 2004c. Dispersant tank testing—a review of procedures and considerations. Pp. 1003–1016 in *Proceedings of the Twenty-Seventh Arctic Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M. and N. Laroche. 1991. *An Introduction to* In-Situ *Burning of Oil Spills.* Paper presented at *In-Situ* Burning Workshop, Sacramento, California, May 21–22, 1991, unpublished.

Fingas, M. and M. Punt. 2000. In-situ *burning: a cleanup technique for oil spills on water.* Environment Canada Special Publication, Ottawa, Ontario, Canada.

Fingas, M. and M. Sydor. 1980. *Development of an Oil Spill model for the St. Lawrence River*. Technical Bulletin No. 116. Environment Canada, Inland Waters Directorate, Water Planning and Management Branch, Ottawa, Ontario, Canada.

Fingas, M.F., D.L. Munn, B. White, R.G. Stoodley and I.D. Crerar. 1989. Laboratory testing of dispersant effectiveness: the importance of oil-to-water ratio and settling time. Pp. 365–373 in *Proceedings of the 1989 International Oil Spill Conference*, San Antonio, Texas. American Petroleum Institute, Washington, D.C.

Fingas, M.F., B. Kolokowski and E.J. Tennyson. 1990. Study of oil spill dispersants effectiveness and physical studies. Pp. 265–287 in *Proceedings of the Thirteenth Arctic Marine Oil Spill Program (AMOP) Technical Seminar*. Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M., I. Bier, M. Bobra and S. Callaghan. 1991. Studies on the physical and chemical behavior of oil and dispersant mixtures. Pp. 411–414 in *Proceedings of the 1991 Oil Spill Conference*, San Diego, California. American Petroleum Institute, Washington, D.C.

Fingas, M.F., D.A. Kyle, Z. Wang and F. Ackerman. 1994. Testing of oil spill dispersant effectiveness in the laboratory. Pp. 905–933 in *Proceedings of the Seventeenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M., B. Fieldhouse and J.V. Mullin. 1995a. Water-in-oil emulsions: How they are formed and how they are broken. Pp. 829–830 in *Proceedings of the 1995 International Oil Spill Conference*, Long Beach, California. American Petroleum Institute, Washington, D.C.

Fingas, M., B. Fieldhouse, L. Gamble and J.V. Mullin. 1995b. Studies of water-in-oil emulsions: Stability, classes, and measurement. Pp. 21–42 in *Proceedings of the Seventeenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M.F., D.A. Kyle, P. Lambert, Z. Wang and J.V. Mullin. 1995c. Analytical procedures for measuring oil spill dispersant effectiveness in the laboratory. Pp. 339–354 in *Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M.F., D. Kyle and E. Tennyson. 1995d. Dispersant effectiveness: Studies into the causes of effectiveness variations. Pp. 92–132 in *The Use of Chemicals in Oil Spill Re-*

sponse, ASTM STP 1252, P. Lane, Ed. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Fingas, M.F., E. Huang, B. Fieldhouse, L. Wang and J.V. Mullin. 1996a. The effect of energy, settling time and shaking time on the swirling flask dispersant apparatus. *Spill Science and Technology Bulletin* 3(4):193–194.

Fingas, M., B. Fieldhouse and J.V. Mullin. 1996b. Studies of water-in-oil emulsions: The role of asphaltenes and resins. Pp. 73–88 in *Proceedings of the Nineteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M., B. Fieldhouse and J.V. Mullin. 1998. Studies of water-in-oil emulsions: Stability and oil properties. Pp. 1–25 in *Proceedings of the Twenty-First Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M., B. Fieldhouse and J. Mullin. 1999. Studies of water-in-oil emulsions: Energy threshold on emulsion formation. Pp. 57–68 in *Proceedings of the Twenty-Second Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M., B. Fieldhouse, J. Lane, and J. Mullin. 2000a. Studies of water-in-oil emulsions: Long-term stability, oil properties, and emulsions formed at sea. Pp. 145–160 in *Proceedings of the Twenty-Third Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M., B. Fieldhouse, J. Lane and J. Mullin. 2000b. Studies of water-in-oil emulsions: Energy and work threshold for emulsion formation. Pp. 19–36 in *Proceedings of the Twenty-Third Arctic and Marine Oil Spill Program (AMOP)* Technical Seminar, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M.F., B. Fieldhouse, P. Lambert, Z. Wang, J. Noonan, J. Lane and J.V. Mullin. 2002a. Water-in-oil emulsions formed at sea, in test tanks, and in the laboratory. Environment Canada Manuscript Report EE-169. Environment Canada, Ottawa, Ontario, Canada.

Fingas, M.F., B. Fieldhouse, J. Noonan, P. Lambert, J. Lane and J. Mullin. 2002b. Studies of water-in-oil emulsions: testing of emulsion formation in OHMSETT, year II. Pp. 29–44 in *Proceedings of Twenty-Fifth Arctic and Marine Oilspill Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Fingas, M.F., B. Fieldhouse and Z. Wang. 2003a. The long term weathering of water-in-oil emulsions. *Spill Science and Technology Bulletin* 8(2) 137–143.

Fingas, M., Z. Wang, B. Fieldhouse and P. Smith. 2003b. The correlation of chemical characteristics of an oil to dispersant effectiveness. Pp. 679–730 in *Proceedings of the Twenty-Sixth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Victoria, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fiocco, R., P.S. Daling, G. DeMarco, R.R. Lessard and G.P. Canevari. 1999. Chemical dispersibility of heavy Bunker Fuel oil. Pp. 173–186 in *Proceedings of the Twenty-Second Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fischer, H.B., E.J. List, R.C.Y. Koh, J. Imberger and N.H. Brooks. 1979. *Mixing in Inland and Coastal Waters*, Academic Press, New York, New York.

Foght, J.M. and D.W.S. Westlake. 1982. Effect of the dispersant Corexit 9527 on the microbial degradation of Prudhoe Bay oil. *Canadian Journal of Microbiology* 28:117–122.

Foght, J.M., P.M. Fedorak and D.W.S. Westlake. 1983. Effect of the dispersant Corexit 9527 on the microbial degradation of sulfur heterocycles in Prudhoe Bay oil. *Canadian Journal of Microbiology* 61:623–627.

Foght, J.M., N.J. Fairbairn and D.W.S. Westlake. 1987. Effect of oil dispersants on microbially-mediated processes in freshwater systems. Pp. 252–263 in *Oil in Freshwater: Chemistry,*

Biology, Countermeasure Technology, J.H. Vandermeulen and S.E. Hrudey. Pergamon Press, Oxford, England.

Foght, J.M., D.L. Gutnick and D.W.S. Westlake. 1989. Effect of emulsan on biodegradation of crude oil by pure and mixed bacterial cultures. *Applied and Environmental Microbiology* 55(1):36–42.

Foy, M.G. 1982. *Acute lethal toxicity of Prudhoe Bay Crude oil and Corexit 9527 to Arctic marine fish and invertebrates.* Technology Development Report, EPS 4-EC-82-3. Environment Canada, Ottawa, Ontario, Canada.

Franklin, F.L. and R. Lloyd. 1986. The relationship between oil droplet size and the toxicity of dispersant/oil mixtures in the Standard MAFF "Sea" test. *Oil & Chemical Pollution* 3:37–52.

Franks, F. 1966. Solute-water interactions and the solubility behavior of long-chain paraffin hydrocarbons. *Nature* 210:87–88.

French-McCay, D.P. 1998. Modeling the Impacts of the North Cape Oil Spill. Pp. 378–430 in *Proceedings of the Twenty-first Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

French-McCay, D.P. 2001. *Development and application of an oil toxicity and exposure model, OilToxEx.* Report prepared for the National Oceanic and Atmospheric Administration, Damage Assessment Center. National Oceanic and Atmospheric Administration, Silver Spring, Maryland.

French-McCay, D.P. 2002. Development and application of an oil toxicity and exposure model, OilToxEx. *Journal of Environmental Toxicology and Chemistry* 21:2080–2094.

French-McCay, D.P. 2003. Development and Application of Damage Assessment Modeling: Example Assessment for the North Cape Oil Spill. *Marine Pollution Bulletin* 47(9-12):341–359.

French-McCay, D.P. 2004. Oil spill impact modeling: Development and validation. *Journal of Environmental Toxicology and Chemistry* 23(10):2441–2456.

French-McCay, D.P. and J.R. Payne. 2001. Model of oil fate and water concentrations with and without application of dispersants. Pp. 611–645 in *Proceedings of the Twenty-Fourth Arctic and Marine Oilspill (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

French-McCay, D.P. and H. Rines. 1997. Validation and use of spill impact modeling for impact assessment. Pp. 829–834 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

French-McCay, D.P., M. Reed, K. Jayko, S. Feng, H. Rines, S. Pavignano, T. Isaji, S. Puckett, A. Keller, F.W. French III, D. Gifford, J. McCue, G. Brown, E. MacDonald, J. Quirk, S. Natzke, R. Bishop, M. Welsh, M. Phillips and B.S. Ingram. 1996. *The CERCLA Type A Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME), Technical Documentation, Volume I–VI.* Contract No. 14-0001-91-C-11. Final Report, submitted to the Office of Environmental Policy and Compliance, U.S. Department of the Interior, Washington, D.C.

Fucik, K.W., T.J. Bright and K.S. Goodman. 1984. Measurements of damage, recovery, and rehabilitation of coral reefs exposed to oil. Pp. 115–133 in *Restoration of Habitats Impacted by Oil Spills*, J. Cairns and A.L. Buikema, eds. Butterworth Press, London, England.

Fucik, K.W., K.A. Carr and B.J. Balcom. 1994. *Dispersed oil toxicity tests with biological species indigenous to the Gulf of Mexico.* OCS Study, MMS 94-0021, Report submitted to the Minerals Management Service, Gulf of Mexico Outer Continental Shelf (OCS) Region, New Orleans, Louisiana.

Fucik, K.W., K.A. Carr and B.J. Balcom. 1995. Toxicity of oil and dispersed oil to the eggs and larvae of seven marine fish and invertebrates from the Gulf of Mexico. Pp. 135–171 in *The Use of Chemicals in Oil Spill Response*, P. Lane, Ed. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Fuller, C. and J.S. Bonner. 2001. Comparative Toxicity of Oil, Dispersant and Dispersed Oil to Texas Marine Species. Pp. 1243–1248 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Fuller, C., J. Bonner, T. McDonald, C. Page, G. Bragin, J. Clark, D. Aurand, A. Hernandez and A. Ernest. 1999. Comparative toxicity of simulated beach sediments impacted with both whole and chemical dispersions of weathered Arabian Medium crude oil. Pp. 659–670 in *Proceedings of the Twenty-Second Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Fuller, C., J.S. Bonner, M.C. Sterling, T.O. Ojo and C.A. Page. 2003. Field instruments for real time *in-situ* crude oil concentration measurements. Pp. 755–764 in *Proceedings of the Twenty-Sixth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Victoria, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Gagnon, R.M. and D.A. Holdaway. 2000. EROD induction and biliary metabolite excretion following exposure to the water accommodated fraction of crude oil and to chemically dispersed crude oil. *Archives of Environmental Contamination and Toxicology* 38(1):70–77.

Galt, J.A. 1995. The Integration of Trajectory Models and Analysis into Spill Response Systems: The Need for a Standard. Pp. 499–507 in *Proceedings of the Second International Oil Spill Research and Development Forum*, London England. International Maritime Organization (IMO), London, England.

Garcia, J.M., L.Y. Wick and H. Harms. 2001. Influence of the nonionic surfactant Brij 35 on the bioavailability of solid and sorbed dibenzofuran. *Environmental Science & Technology* 35(10):2033–2039.

Garrett, R.M., I.J. Pickering, E.H. Copper and R.C. Prince. 1998. Photooxidation of polycyclic aromatic hydrocarbons in crude oils. Pp. 99–114 in *Proceedings of the Twenty-First Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Gearing, P.J. and J.N. Gearing. 1982a. Behavior of No. 2 fuel oil in the water column of controlled ecosystems. *Marine Environmental Research* 6:115–132.

Gearing, P.J. and J.N. Gearing. 1982b. Transport of No. 2 fuel oil between water column, surface microlayer, and atmosphere in controlled ecosystems. *Marine Environmental Research* 6:133–143.

Gearing, P.J., J.N. Gearing, R.J. Pruell, T.L. Wade and J.G. Quinn. 1980. Partitioning of No. 2 fuel oil in controlled ecosystems: Sediments and suspended particulate matter. *Environmental Science and Technology* 14:1129–1136.

George, S.E., G.M. Nelson, M.J. Kohan, S.H. Warren, B.T. Eischen and L.R. Brooks. 2001. Oral treatment of Fischer 344 rats with weathered crude oil and a dispersant influences intestinal metabolism and microbiota. *Journal of Toxicology and Environmental Health, Part A* 63:297–316.

George-Ares, A. and J.R. Clark. 2000. Aquatic toxicity of two Corexit® dispersants. *Chemosphere* 40:897–906.

George-Ares, A., J.R. Clark, G.R. Biddinger and M.L. Hinman. 1999. Comparison of Test Methods and Early Toxicity Characterization for Five Dispersants. *Ecotoxicology and Environmental Safety* 42:138–142.

Georgiades, E.T., D.A. Holdaway, S.E. Brennan, J.S. Butty and A. Temara. 2003. The impact of oil-derived products on the behaviour and biochemistry of the eleven-armed asteroid *Coscinasterias muricata* (Echinodermata). *Marine Environmental Research* 55:257–276.

Getter, C.D. and T.G. Ballou. 1985. Field experiments on the effects of oil and dispersant on mangroves. Pp. 577–582 in *Proceedings of the 1985 International Oil Spill Conference*, Los Angeles, California. American Petroleum Institute, Washington, D.C.

Gilfillan, E.S., D.S. Page and J.C. Foster. 1986. *Tidal area dispersant project: Fate and Effects of Chemically Dispersed Oil in the Nearshore Benthic Environment.* Final Report, Publication Number 4440. American Petroleum Institute, Washington, D.C.

Goodman, R.H. 2003. Is SMART Really that Smart. Pp. 779–786 in *Proceedings of the Twenty-Sixth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Victoria, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Goodman, R.H. and M.F. Fingas. 1988. The use of remote sensing in the determination of dispersant effectiveness. *Spill Technology Newsletter* 13(3):55–58.

Goodman, R.H. and M.R. MacNeill. 1984. The use of remote sensing in the determination of dispersant effectiveness. Pp. 143–160 in *Oil Spill Chemical Dispersants: Research, Experience, and Recommendations*, T.E. Allen, Ed. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Gordon, D.C., Jr., P.D. Keizer and N.J. Prouse. 1973. Laboratory studies of the accommodation of some crude and residual fuel oils in sea water. *Journal of the Fisheries Research Board of Canada* 30:1611–1618.

Gould, J.R. and J. Lindstedt-Siva. 1991. Santa Barbara to Mega Borg and beyond: A review of API's spill program and priorities. Pp. 341–352 in *Proceedings of the 1991 International Oil Spill Conference*, San Diego, California. American Petroleum Institute, Washington, D.C.

Green, D.R., J. Buckley and B. Humphrey. 1982. *Fate of chemically dispersed oil in the sea: A report on two field experiments.* Environment Canada Report EPS 4-EC-82-5. Environment Canada, Ottawa, Ontario, Canada.

Gregory, C.L., A.A. Allen and D.H. Dale. 1999. Assessment of potential oil spill recovery capabilities. Pp. 527–534 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Grothe, D.R., K.L. Dickson, D.K. Reed-Judkins, Eds. 1996. *Whole Effluent Toxicity Testing: An Evaluation of Methods and Prediction of Receiving System Impacts.* Society of Environmental Toxicology and Chemistry Press, Pensacola, Florida.

Gugg, P.M., C.B. Henry and S.P. Glenn. 1999. Proving dispersants work. Pp. 1007–1010 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Gulec, I. and D.A. Holdaway. 2000. Toxicity of crude oil and dispersed crude oil to ghost shrimp *Palaemon serenus* and larvae of Australian Bass *Macquaria novemaculeata*. *Environmental Toxicology* 15:91–98.

Gulec, I., B. Leonard and D.A. Holdaway. 1997. Oil and Dispersed Oil Toxicity to Amphipods and Snails. *Spill Science and Technology Bulletin* 4:1–6.

Guyomarch, J., F.X. Merlin and S. Colin. 1999a. Study of the feasibility chemical dispersion of viscous oils and water-in-oil emulsions. Pp. 219–230 in *Proceedings of the Twenty-Second Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Guyomarch, J., F.-X. Merlin and P. Bernanose. 1999b. Oil interaction with mineral fines and chemical dispersion: behaviour of the dispersed oil in coastal or estuarine conditions. Pp. 137–149 in *Proceedings of the Twenty-Second Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Guyomarch, J., O. Kerfourn and F.X. Merlin. 1999c. Dispersants and demulsifiers: studies in the laboratory, harbor and polludrome. Pp. 195–202 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Guyomarch, J., S. Le Floch and F.-X. Merlin. 2002. Effect of suspended mineral load, water salinity and oil type on the size of oil–mineral aggregates in the presence of chemical dispersant. *Spill Science & Technology Bulletin* 8(1):95–100

Hammond, T.M., C. Pattiaratchi, D. Eccles, M. Osborne, L. Nash and M. Collins. 1987. Ocean Surface Current Radar (OSCR) Vector Measurements on Inner Continental Shelf. *Continental Shelf Research* 7:411–431.

Harris, C. 1997. The Sea Empress incident: overview and response at sea. Pp. 177–184 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

Hartwick, E.B., R.S.S. Wu and D.B. Parker. 1982. Effects of a crude oil and an oil dispersant Corexit 9527 on populations of the littleneck clam *Protothaca staminea*. *Marine Environmental Research* 6:291–306.

Henrichs, S., M. Luoma and S. Smith. 1997. *A study of the adsorption of aromatic hydrocarbons by marine sediments.* Final Report OCS Study MMS 97-0002. Report submitted to the Minerals Management Service, Gulf of Mexico Outer Continental Shelf (OCS) Region, New Orleans, Louisiana.

Henry, C. 2004. *Response goals and the role of dispersants.* Presentation to the National Research Council Committee on Understanding Oil Spill Dispersants: Efficacy and Effects, March 15–16, 2004, Washington, D.C., unpublished. National Research Council, Washington, D.C.

Henry, C. and P.O. Roberts. 2001. Background fluorescence values and matrix effects observed using SMART protocols in the Atlantic Ocean and Gulf of Mexico. Pp. 1203–1207 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Henry, C.B., P.O. Roberts and E.B. Owens. 1999. A primer on *in-situ* fluorimetry to monitor dispersed oil. Pp. 225–228 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Herbes, S.E. 1977. Partitioning of polycyclic aromatic hydrocarbons between dissolved and particulate phases in natural waters. *Water Research* 11:493–496.

Hill, P.S., A. Khelifa and K. Lee. 2003. Time scale for oil droplet stabilization by mineral particles in turbulent suspensions. *Spill Science and Technology Bulletin* 8(1):73–82.

Hillman, S.O., S.D. Hood, M.T. Bronson and G. Shufelt. 1997. Dispersant field monitoring procedures. Pp. 521–539 in *Proceedings of the Twentieth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Ho, K., L. Patton, J.S. Latimer, R.J. Pruell, M. Pelletier, R. McKinney and S. Jayaraman. 1999. The chemistry and toxicity of sediment affected by oil from the North Cape spilled into Rhode Island Sound. *Marine Pollution Bulletin* 38:314–323.

Hodgins, D.O., R.H. Goodman and M.F. Fingas. 1993. Forcasting Surface Current Measured with HF Radar. Pp. 1083–1094 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Canada. Environment Canada. Ottawa, Ontario, Canada.

Hodson, P.V., D.G. Dixon and K.L.E. Kaiser. 1988. Estimating the Acute Toxicity of Waterborne Chemicals in Trout from Measurements of Median Lethal Dose and the Octanol-Water Partition Coefficient. *Journal of Environmental Toxicology and Chemistry* 7:443–454.

Hoffman, E.J. and J.G. Quinn. 1978. A comparison of Argo Merchant oil and sediment hydrocarbons from Nantucket Shoals. Pp. 80–88 in *In the wake of the Argo Merchant—Proceedings of a Symposium*. University of Rhode Island, Center for Ocean Management Studies, Kingston, Rhode Island.

Hoffman, E.J. and J.G. Quinn. 1979. Gas chromatographic analysis of Argo Merchant oil and sediment hydrocarbons at the wreck site. *Marine Pollution Bulletin* 10:20–24.

Hokstad, J.N., B. Knudsen and P.S. Daling. 1996. *Oil-surfactant interaction and mechanism studies—Part 1: Leaching of surfactants form oil to water. Chemical composition of dispersed oil.* IKU No. 22.2043.00/21/95, ESCOST report No. 21. SINTEF Group report to Esso Norge A.S. SINTEF Group, Trondheim, Norway.

Hoult, D.P. 1972. Oil spreading on the sea. *Annual Review of Fluid Mechanics* 4:341–367.

Howlett, E., K. Jayko and M. Spaulding. 1993. Interfacing Real-Time Information with OILMAP. Pp. 539–548 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Canada. Environment Canada. Ottawa, Ontario, Canada.

Huang, J.C. and F.C. Monastero. 1982. *Review of the state-of-the-art of oil spill simulation models.* Final report submitted by Raytheon Ocean Systems Company, East Providence, Rhode Island to the American Petroleum Institute, Washington, D.C. American Petroleum Institute, Washington, D.C.

Huang, W. and M. Spaulding. 1995. 3D model of estuarine circulation and water quality induced by surface discharges. *Journal of Hydraulic Engineering*, 121(4):300–311.

Humphrey, B., P.D. Boehm, M.C. Hamilton and R.J. Nordstrom. 1987. The fate of chemically dispersed and untreated crude oil in Arctic oil spill. *Arctic* 40 (Supplement 1):149–161.

Hurlbert, S.H. 1984. Pseudoreplication and the design of ecological field experiments. *Ecological Monographs* 54(2):187–211.

Ichiye, T. 1967. Upper ocean boundary-layer flow determined by dye diffusion. *Physics of Fluids* 10:270–277.

Inchcape Testing Services. 1995. *Laboratory test data for Corexit 9500 and Corexit 9527.* Inchcape Testing Services, Houston, Texas.

International Petroleum Industry Environmental Conservation Association (IPIECA). 2000. *Choosing Spill Response Options to Minimize Damage—Net Environmental Benefit Analysis.* IPIECA Report Series, Volume 10. International Petroleum Industry Environmental Conservation Association, London, England.

Jahns, H.O., J.R. Bragg, L.C. Dash and E.H. Owens. 1991. Natural Cleaning of Shorelines Following the Exxon Valdez Spill. Pp. 167–176 in *Proceedings of the 1991 International Oil Spill Conference*, San Diego, California. American Petroleum Institute, Washington, D.C.

Jasper, W.L., T.J. Kim and M.P. Wilson. 1978. Drop Size Distributions in a Treated Oil-Water System. Pp. 203–216 in *Chemical Dispersants for the Control of Oil Spills*, L.T. McCarthy, G.P. Lindblom and H.F. Walter, Eds. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Jenssen, B.M. 1994. Review article: effects of oil pollution, chemically treated oil, and cleaning on the thermal balance of birds. *Environmental Pollution* 86:207–215.

Jenssen, B.M. and M. Ekker. 1991. Effects of plumage contamination with crude oil dispersant mixtures on thermoregulation in common eiders and mallards. *Archives of Environmental Contamination and Toxicology* 20:398–403.

Jezequel, R., S. Lefloch, F.-X. Merlin, J. Drewes and K. Lee. 1998. The influence of microorganisms on oil-mineral fine interactions in low energy coastal environment: Preliminary results. Pp. 957–962 in *Proceedings of the Twenty-first Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Jezequel, R., F.-X. Merlin and K. Lee. 1999. The influence of microorganisms on oil-mineral fine interactions in low energy coastal environment. Pp. 771–775 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Johannes, R.E. 1975. Pollution and degradation of coral reef communities. Pp. 13–51 in *Tropical Marine Pollution*, E.J. Ferguson Wood and R.E. Johannes, Eds. Elsevier, New York, New York.

Johansen, O. 1984. The Halten Bank experiment—observations and model studies of drift and fate of oil in the marine environment, Pp. 18–36 in *Proceedings of the Eleventh Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Johansen, O. 2000. DeepBlow—a Lagrangian plume model for deep water blowouts. *Spill Science and Technology Bulletin* 6(2):103–111.

Johansen, O. and I.M. Carlsen. 2002. *Assessment of methods for dispensing dispersant into subsea blowouts.* SINTEF Applied Chemistry, Trondheim, Norway.

Johansson, S.U., U. Larsson and P.D. Boehm. 1980. The Tsesis oil spill impact on the pelagic ecosystem. *Marine Pollution Bulletin* 11:284–293.

Jones, R.K. 1996. Method for estimating boiling temperatures of crude oils. *Journal of Environmental Engineering* 122(8):761–763.

Jones, R.K. 1997. A Simplified Pseudo-Component of Oil Evaporation Model. Pp. 43–61 in *Proceedings of the Twentieth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Jordan, R.E. and J.R. Payne. 1980. *Fate and Weathering of Petroleum Spills in the Marine Environment: A Literature Review and Synopsis.* Ann Arbor Science Publishers, Incorporated, Ann Arbor, Michigan.

Kaku, V.J., M.C. Boufadel and A.D. Venosa. 2002. Evaluation of the mixing energy in the EPA flask tests for dispersants effectiveness. Pp. 211–218 in *Oil Spills 2002*. Wessex Institute of Technology, Ashurst, Southampton, United Kingdom. [Online] Available at: http://www.temple.edu/environment/Papers/kakugreece.pdf [December 20, 2004].

Karickhoff, S.W. 1981. Semi-empirical estimation of sorption of hydrophobic pollutants on natural sediments and soils. *Chemosphere* 10:833–846.

Kaser, R.M., J. Gahn and C. Henry. 2001. Blue Master: Use of Corexit 9500 to Disperse IFO 180 Spill. Pp. 815–819 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Kennedy, C.J., N.J. Gassman and P.J. Walsh. 1992. The fate of benzo[a]pyrene in the scleractinian corals *Favia fragrum* and *Montastrea annularis*. *Marine Biology* 112:313–318

Kennicutt, M.C. II, T.L. Wade, N.L. Guinasso, Jr. and J.M. Brooks. 1991. The Mega Borg Incident: A comparison of response, mitigation and impact. Pp. 275–280 in *Proceedings of the 1991 Offshore Technology Conference*, Houston, Texas. Offshore Technology Conference, Houston, Texas.

Kerr, C.L. and C.S. Barrientos, Eds. 1979. *Workshop on the physical behavior of oil in the marine environment.* Princeton University Press, Princeton, New Jersey.

Khelifa, A., P. Stoffyn-Egli, P.S. Hill and K. Lee. 2002. Characteristics of oil droplets stabilized by mineral particles: effect of oil types and temperature. *Spill Science and Technology Bulletin* 8(1):19–30.

Khelifa, A., P.S. Hill, L.O. Ajijolaiya and K. Lee. 2004. Modeling the effect of sediment size on OMA formation. Pp. 383–395 in *Proceedings of the Twenty-Seventh Arctic Marine Oilspill Program (AMOP) Technical Seminar,* Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Kiesling, R.W., S.K. Alexander and J.W. Webb. 1988. Evaluation of alternative oil-spill cleanup techniques in a *Spartina-alterniflora* salt-marsh. *Environmental Pollution* 55(3): 221–238.

Kirstein, B.E. 1992. *Adaptation of the Minerals Management Service's Oil-Weathering Model for Use in the Gulf of Mexico Region.* Contract No. 14-35-0001-30537. Minerals Management Service, Gulf of Mexico Outer Continental Shelf (OCS) Region, New Orleans, Louisiana.

Knap, A.H. 1987. Effects of chemically dispersed oil on the brain coral *Diploria strigosa*. *Marine Pollution Bulletin* 18(3):119–122.

Knap, A.H., T.D. Sleeter, R.E. Dodge, S.C. Wyers, H.R. Frith and S.R. Smith. 1983. The effects of oil spills and dispersants use on corals: A review and multidisciplinary experimental approach. *Oil and Petrochemical Pollution* 1:157–169.

Knap, A.H., S.C. Wyers, R.E. Dodge, T.D. Sleeter, H.R. Frith, S.R. Smith and C.B. Cook. 1985. The effects of chemically and physically dispersed oil on the brain coral, *Diploria strigosa* (Dana). Pp. 547–551 in *Proceedings of the 1985 International Oil Spill Conference*, Los Angeles, California. American Petroleum Institute, Washington, D.C.

Knudsen, O.O., P.J. Brandvik and A. Lewis. 1994. Treating oil spills with W/O emulsion inhibitors—a laboratory study of surfactant leaching from the oil to the water phase. Pp. 1023–1034 in *Proceedings of the Seventeenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada. Ottawa, Ontario, Canada.

Kochany, J. and R.J. Maguire. 1994. Abiotic Transformations of Polynuclear Aromatic Hydrocarbons and Polynuclear Aromatic Nitrogen Heterocycles in Aquatic Environments. *Science of the Total Environment* 144:17–31.

Koh, R.C.Y. and Fan, L-N. 1970. *Mathematical models for the prediction of temperature distributions resulting from the discharge of heated water into large bodies of water*. Report prepared under Contract 14-12-570 by Tetra Tech, Inc., Pasadena CA, for U.S. Environmental Protection Agency's Water Quality Office. U.S. Environmental Protection Agency, Office of Water, Washington, D.C.

Kolluru, V.S., M.L. Spaulding and E.L. Spaulding. 1993. Application and Verification of Worldwide Oil Spill Model (WOSM) to Selected Spill Events. Pp. 573–585 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Canada. Environment Canada. Ottawa, Ontario, Canada.

Kovats, von E. 1958. Gas-Chromatographische Charakterisierung Organischer Verbindungen, Teil 1: Retentionsindices Aliphatischer Halogenide, Alkohole, Aldehyde und Ketone. *Helvetica Chimica Acta* 10:1915–1932.

Kraly, J., R.G. Pond, D.V. Aurand, G.M. Coelho, A.H. Walker, B. Martin, J. Caplis and M. Snowby. 2001. Ecological risk assessment principles applied to oil spill response planning. Pp. 177–183 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Kucklick, J.H. and D. Aurand. 1997. Historical dispersant and *in-situ* burning opportunities in the United States. Pp. 205–210 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

LaBelle, R.P. and W.R. Johnson, 1993. Stochastic Oil Spill Analysis for Cook Inlet/Shelikof Strait. Pp. 573–585 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lai, H.C. and C.P. Lim. 1984. Comparative toxicities of various crude oils to mangroves. Pp. 12–138 in *Fate and Effects of Oil in the Mangrove Environment*, H.C. Lai and M.C. Feng, Eds. Universiti Sains Malaysia, Pulau Pinang, Malaysia.

Lambert, G., D.B. Peakall, B.J.R. Philogene and F.R. Engelhardt. 1982. Effect of oil and oil dispersant mixtures on the basal metabolic rate of ducks. *Bulletin of Environmental Contamination and Toxicology* 29:520–524.

Lambert, P., B. Fieldhouse, Z. Wang, M. Fingas, M. Goldthorp, L. Pearson and E. Collazzi. 2001a. A laboratory study of a flow-through fluorometer for measuring oil-in-water levels. Pp. 23–45 in *Twenty-Fourth Arctic and Marine Oilspill (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Lambert, P., M. Goldthorp, B. Fieldhouse, Z. Wang, M.F. Fingas, L. Pearson and E. Collazzi. 2001b. A review of oil-in-water monitoring techniques. Pp. 1375–1380 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Landrum, P.F., J.P. Giesy, J.T. Oris and P.M. Allred. 1987. Photoinduced toxicity of polycyclic aromatic hydrocarbons to aquatic organisms. Pp. 304–318 in *Oil in Freshwater*, J.H. Vandermeulen and S.E. Hrudey, Eds. Pergamon Press, New York, New York.

Lane, P.A., J.H. Vandermeulen, M.J. Crowell and D.G. Patriquin. 1987. Impact of experimentally dispersed crude oil on vegetation in a northwestern Atlantic salt marsh-preliminary observations. Pp. 509–514 in *Proceedings of the 1987 International Oil Spill Conference*, Baltimore, Maryland. American Petroleum Institute, Washington, D.C.

LaRiviere, D.J., R.L. Autenrieth and J.S. Bonner. 2003. Redox dynamics during recovery of an oil-impacted estuarine wetland. *Water Research* 37:3307–3318.

Law, A.T. 1995. Toxicity study of the oil dispersant Corexit 9527 on *Macrobrachium rosenbergii* (de Man) egg hatchability by using a flow-through bioassay technique. *Environmental Pollution* 88:341–343.

Law, R., C.A. Kelly, K.L. Graham, R.J. Woodhead, P.E.J. Dyrynda and E.A. Dyrynda. 1997. Hydrocarbon and PAH in fish and shellfish from Southwest Wales following the Sea Empress oilspill in 1996. Pp. 205–211 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

Lawrence, A.S.C. and W. Killner. 1948. Emulsions of seawater in Admiralty fuel oil with special reference to their demulsification. *Journal of the Institute of Petroleum* 34(299):821–857.

Ledwell, J.R., A.J. Watson and C.S. Law. 1998. Mixing of a tracer in the pycncline, *Journal of Geophysical Research* 103(C10):21499–21529.

Lee, H. 1992. Models, muddles and mud: Predicting bioaccumulation of sediment associated pollutants. Pp. 267–293 in *Sediment Toxicity Assessment*, G.A. Burton, Ed. CRC Press, Boca Raton, Florida.

Lee, H.W., N. Kobayashi and C.-R. Ryu. 1990. *Review on oil spills and their effects.* Report Number CACR-90-03. Center for Applied Coastal Research, Department of Civil Engineering, University of Delaware, Newark, Delaware.

Lee, K. 2002. Oil-particle interactions in aquatic environments: influence on the transport, fate, effect and remediation of oil spills. *Spill Science & Technology Bulletin* 8(1):3–8.

Lee, K., C.S. Wong, W.J. Cretney, F.A. Whitney, T.R. Parsons, C.M. Lalli and J. Wu. 1985. Microbial response to crude oil and Corexit 9527: SEAFLUXES enclosure study. *Microbial Ecology* 11:337–351.

Lee, K., T. Lunel, P. Wood, R. Swannell and P. Stoffyn-Egli. 1997a. Shoreline cleanup by acceleration of clay-oil flocculation processes. Pp. 235–240 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

Lee, K., S. St-Pierre and A.M. Weise. 1997b. Enhanced oil biodegradation with mineral fine interaction. Pp. 715–722 in *Proceedings of the Twentieth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia. Environment Canada, Ottawa, Ontario, Canada.

Lee, K., P. Stoffyn-Egli, P.A. Wood and T. Lunel. 1998. Formation and structure of oil-mineral fines aggregates in coastal environments. Pp. 911–921 in *Proceedings of the Twenty-First Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Lee, K., P. Stoffyn-Egli and E.H. Owens. 2001. Natural dispersion of oil in a freshwater ecosystem: Desaguadero pipeline spill, Bolivia. Pp. 1445–1448 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Lee, K., P. Stoffyn-Egli and E.H. Owens. 2002. The OSSA II pipeline oil spill: natural mitigation of a riverine oil spill by oil–mineral aggregate formation. *Spill Science and Technology Bulletin* 7(3–4):149–154.

Leech, M., M. Walker, M. Wiltshire and A. Tyler. 1993. OSIS: A Windows 3 Oil Spill Information System. Pp. 549–572 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Le Floch, S., J. Guyomarch, F.-X. Merlin, P. Stoffyn-Egli, J. Dixon and K. Lee. 2002. The influence of salinity on oil-mineral aggregate formation. *Spill Science & Technology Bulletin* 8(1):65–71.

Legore, R.S., D.S. Marzalek, J.E. Hoffman and J.E. Cuddeback. 1983. A field experiment to assess impact of chemically dispersed oil on Arabian Gulf corals. Pp. 51–60 in *Proceedings of the Middle East Oil Technical Conference*, Manama, Bahrain. Society of Petroleum Engineers, Richardson, Texas.

Legore, S., D.S. Marszalek, L.J. Danek, M.S. Tomlinson, J.E. Hoffman and J.E. Cuddeback. 1989. Effect of chemically dispersed oil on Arabian Gulf corals: A field experiment. Pp. 375–380 in *Proceedings of the 1989 International Oil Spill Conference*, San Antonio, Texas. American Petroleum Institute, Washington, D.C.

Lehr, W. 1996. Progress in Oil Spread Modeling. Pp. 889–894 in *Proceedings of the Nineteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Lehr, W.J., H.M. Cekirge, R.J. Fraga and M.S. Belen. 1984. Empirical studies of the spreading of oil spills. *Oil and Petrochemical Pollution* 2:7–12.

Lehr, W.J., R. Overstreet, R. Jones and G. Watabayashi. 1992. ADIOS-Automatic Data Inquiry for Oil Spills. Pp. 31–45 in *Proceedings of the Fifteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Lehr, W.J., D. Wesley, D. Simecek-Beatty, R. Jones, G. Kachook and J. Lankford. 2000. Algorithm and interface modifications of the NOAA oil spill behavior model. Pp. 525–539 in *Proceedings of the Twenty-Third Arctic and Marine Oil Spill Program (AMOP)* Technical Seminar, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Lehr, W., R. Jones, M. Evans, D. Simecek-Beatty and R. Overtreet. 2002. Revisions of the ADIOS oil spill model. *Environmental Modeling and Software* 17:191–199.

Leibovich, S. and J.L. Lumley. 1982. Interaction of turbulence and Langmuir cells in vertical transport of oil droplets. Pp. 271–276 in *Proceedings of the First International Conference on Meteorology and Air/Sea Interaction of the Coastal Zone*, The Hague, Netherlands. American Meteorological Society, Boston, Massachusetts.

Lessard, R.R., D.V. Aurand, G. Coelho, J.C. Clark, G. Bragin, C.M. Fuller, T.J. McDonald, R. Jamail and A. Steen. 1999. Design and implementation of a mesocosm experiment on the environmental consequences of nearshore dispersant use. Pp. 1027–1030 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Levine, E. 1999. Development and implementation of the dispersant observation job aid. Pp. 1015–1018 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Lewis, A. 2004. *Experimental and field case studies in dispersant effectiveness*. Presentation to the National Research Council Committee on Understanding Oil Spill Dispersants: Efficacy and Effects, March 15–16, 2004, Washington, D.C., unpublished. National Research Council, Washington, D.C.

Lewis, A. and D. Aurand. 1997. Putting Dispersants to work: Overcoming obstacles. Pp. 157–164 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

Lewis, A., P.S. Daling, R. Fiocco and A.B. Nordvik. 1994. Chemical dispersion of oil and water-in-oil emulsions—A comparison of bench-scale test methods and dispersant

treatment in meso-scale flume. Pp. 979–1010 in *Proceedings of the Seventeenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lewis, A., P.S. Daling, T. Strom-Kristiansen, A.B. Nordvik and R. Fiocco. 1995a. Weathering and chemical dispersion of oil at sea. Pp. 157–164 in *Proceedings of the 1995 International Oil Spill Conference*, Long Beach, California. American Petroleum Institute, Washington, D.C.

Lewis, A., P.S. Daling, T. Strom-Kristiansen and P.J. Brandvik. 1995b. The behavior of Sture blend crude oil spilled at sea and treated with dispersant. Pp. 453–469 in *Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lewis, A., A. Crosbie, L. Davies and T. Lunel. 1998a. Large scale field experiments into oil weathering at sea and aerial application of dispersants. Pp. 319–343 in *Proceedings of the Twenty-first Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Lewis A., A. Crosbie, L. Davies and T. Lunel. 1998b. Dispersion of emulsified oil at sea. AEA Technology report. AEAT-3475. AEA Technology, National Environmental Technology Centre (NETCEN, Didcot, Oxfordshire, England.

Li, M. and C. Garrett. 1998. The relationship between oil droplet size and upper ocean turbulence. *Marine Pollution Bulletin* 36(12):961–970.

Linden, O., A. Rosemarin, A. Lindskog, C. Hoglund and S. Johansson. 1987. Effects of oil and oil dispersant on an enclosed marine ecosystem. *Environmental Science and Technology* 2:374–382.

Lindstedt-Siva, J. 1987. Advance planning for dispersant use. Pp. 329–333 in *Proceedings of the 1987 International Oil Spill Conference*, Baltimore, Maryland. American Petroleum Institute, Washington, D.C.

Lindstedt-Siva J. 1991. U.S. oil spill policy hampers response and hurts science. Pp. 349–352 in *Proceedings of the 1991 International Oil Spill Conference*, San Diego, California. American Petroleum Institute, Washington, D.C.

Lindstrom, J.E. and J.F. Braddock. 2002. Biodegradation of petroleum hydrocarbons at low temperature in the presence of the dispersant Corexit 9500. *Marine Pollution Bulletin* 44(8):739–747.

Lindstrom, J.E., D.M. White and J.F. Braddock. 1999. *Biodegradation of dispersed oil using Corexit 9500.* Report to the Alaska Department of Environmental Conservation, Division of Spill Prevention and Response. Alaska Department of Environmental Conservation, Juneau, Alaska.

Literathy, P., S. Haider, O. Samhan and G. Morel. 1989. Experimental studies on biological and chemical oxidation of dispersed oil in seawater. *Water Science and Technology* 21:845–856.

Little, D.I. and D.L. Scales. 1987a. Effectiveness of a type III dispersant on low-energy shorelines. *Proceedings of the 1987 International Oil Spill Conference*, Baltimore, Maryland. American Petroleum Institute, Washington, D.C.

Little, D.I. and D.L. Scales. 1987b. The persistence of oil stranded on sediment shorelines. *Proceedings of the 1987 International Oil Spill Conference*, Baltimore, Maryland. American Petroleum Institute, Washington, D.C.

Little, D.I. and D.L. Scales. 1987c. The effectiveness of a new type III dispersant in the treatment of weathered crude and emulsified fuel oils on saltmarshes and sandflats. Pp. 217–219 in *Fate and Effects of Oil in Marine Ecosystems*, J. Kuiper and W.J. Van Den Brink, Eds. Martinus Nijhoff Publishers, Dordrecht, The Netherlands.

Long, S.M. and D.A. Holdaway. 2002. Acute toxicity of crude and dispersed oil to *Octopus pallidus* (Hoyle, 1885) hatchlings. *Water Research* 36:2769–2776.

Louchouarn, P., J.S. Bonner, P. Tissot, T.J. McDonald, C.B. Fuller and C.A. Page. 2000. Quantitative determination of oil films/slicks from water surfaces using a modified solid-phase extraction (SPE) sampling method. Pp. 59–68 in *Proceedings of the Twenty-Third Arctic and Marine Oil Spill Program (AMOP)* Technical Seminar, Vancouver, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Lunel, T. 1993. Dispersion: Oil droplet size measurement at sea. Pp. 1023–1056 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lunel, T. 1994a. Dispersion of a large experimental slick by aerial application of dispersant. Pp. 951–979 in *Proceedings of the Seventeenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lunel, T. 1994b. Field trials to determine quantitative estimates of dispersant efficiency at sea. Pp. 1011–1022 in *Proceedings of the Seventeenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lunel, T. 1995a. Dispersant effectiveness at sea. Pp. 147–155 in *Proceedings of the 1995 International Oil Spill Conference*, Long Beach, California. American Petroleum Institute, Washington, D.C.

Lunel, T. 1995b. Understanding the mechanism of dispersion through oil droplet size measurements at sea. Pp. 240–285 in *The Use of Chemicals in Oil Spill Response*, ASTM STP 1252, P. Lane, Ed. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Lunel, T. 1998. *Sea Empress* spill: Dispersant operations, effectiveness, and effectiveness monitoring. Pp. 59–78 in *Proceedings of the Dispersant Use in Alaska: A Technical Update*, Anchorage, Alaska. Prince William Sound Oil Spill Recovery Institute, Cordova, Alaska.

Lunel, T. and L. Davies. 1996. Dispersant effectiveness in the field on fresh oils and emulsions. Pp. 1355–1394 in *Proceedings of the Nineteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Lunel, T. and A. Lewis. 1993a. Effectiveness of demulsifiers in sea trials: The use of fluorometry, surface sampling, and remote sensing to determine effectiveness. Pp. 179–202 in *Formation and Breaking of Water-in-Oil Emulsions: Workshop Proceedings*, A.H. Walker, D.L. Ducey, Jr, J.R. Gould and A.B. Nordvik, Eds. Marine Spill Response Corporation, Washington, D.C.

Lunel, T. and A. Lewis. 1993b. Oil concentrations below a demulsifier-treated slick. Pp. 955–972 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lunel, T., G. Baldwin and F. Merlin. 1995a. Comparison of meso-scale and laboratory dispersant tests with dispersant effectiveness measured at sea. Pp. 629–651 in *Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lunel, T., L. Davies and P.J. Brandvik. 1995b. Field trials to determine dispersant effectiveness at sea. Pp. 603–627 in *Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lunel, T., L. Davies, A.C.T. Chen and R.A. Major. 1995c. Field test of dispersant application by fire monitor. Pp. 559–574 in *Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Lunel, T.J., J. Rusin, N. Bailey, C. Halliwell and L. Davies. 1996. A successful at-sea response to the Sea Empress spill. Pp. 1499–1520 in *Proceedings of the Nineteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Lunel, T.J. Rusin, N. Bailey, C. Halliwell and L. Davies. 1997a. The net environmental benefit of a successful dispersant application at the *Sea Empress* incident. Pp. 185–194 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

Lunel, T., P. Wood and L. Davies, 1997b. Dispersant effectiveness in field trials and in operational response. Pp. 923–926 in *Proceedings of the 1997 International Oil Spill Conference*, Fort Lauderdale, Florida. American Petroleum Institute, Washington, D.C.

Lyklema, J. 2000. *Fundamentals of Interface and Colloid Science, Volume III: Liquid-Fluid Interfaces.* Academic Press, Incorporated, San Diego, California.

Mackay, D. 1987. *Formation and stability of water-in-oil emulsions.* DIWO Report No. 1. IKU. SINTEF Group, Trondheim, Norway.

Mackay, D. 1993. *Effectiveness of dispersants applied following the Exxon Valdez spill.* Report from the University of Toronto for Exxon Company. ExxonMobil Research and Engineering Company, Fairfax, Virginia.

Mackay, D. 1995. *Effectiveness of chemical dispersants under breaking wave conditions.* Pp. 310–340 in *Use of Chemicals in Oil Spill Response.* ASTM special technical publication 1252. American Society of Testing Materials, Philadelphia, Pennsylvania.

Mackay, D. and A. Chau. 1986. The effectiveness of chemical dispersants: a discussion of laboratory and field tests results. *Oil and Chemical Pollution* 3:405–415.

Mackay, D. and K. Hossain. 1982. *An exploratory study of naturally and chemically dispersed oil.* EE-35. Report to Environment Canada. Environment Canada, Ottawa, Ontario, Canada.

Mackay, D. and P.J. Leinonen. 1977. *Mathematical model of the behavior of oil spills on water with natural and chemical dispersion.* Economic and Technical Review Report EPS-3-EC-77-19. Prepared Environment Canada. Environment Canada, Ottawa, Ontario, Canada.

Mackay, D. and R.M. Matsugu. 1973. Evaporation rates of liquid hydrocarbon spills on land and water. *Canadian Journal of Chemical Engineering* 8:434–439.

Mackay, D. and W.Y. Shiu. 1976. Aqueous solubilities of weathered northern crude oils. *Bulletin of Environmental Contamination and Toxicology* 15(1):101–109.

Mackay, D. and P.G. Wells. 1983. Effectiveness, behavior, and toxicity of dispersants. Pp. 65–71 in *Proceedings of the 1983 International Oil Spill Conference*, San Antonio, Texas. American Petroleum Institute, Washington, D.C.

Mackay, D., J.S. Nadeau and C. Ng. 1978. A small-scale laboratory dispersant effectiveness test. Pp. 35–49 in *Chemical Dispersants for the Control of Oil Spills*, L.T. McCarthy, G.P. Lindblom and H.F. Walter, Eds. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Mackay, D., S. Paterson and K. Trudel. 1980a. *A mathematical model of oil spill behavior.* Publication EE-7. Report for Environment Canada. Department of Chemical and Applied Chemistry, University of Toronto, Canada.

Mackay, D., I. Buist, R. Mascarenhas and S. Paterson. 1980b. *Oil spill processes and models.* Publication EE-8. Report for Environment Canada. Environment Canada, Ottawa, Ontario, Canada.

Mackay, D, W.Y. Shiu, K. Hossain, W. Stiver, D. McCurdy and S. Peterson. 1982. *Development and Calibration of an Oil Spill Behavior Model.* Report No. CG-D-27-83. U.S. Coast Guard, Research and Development Center, Groton, Connecticut.

Mackay, D.A., A. Chau, K. Hossain and M. Bobra. 1984. Measurement and prediction of the effectiveness of oil spill chemical dispersants. *Oil Spill Chemical Dispersants, Research Experience and Recommendations*, T.E. Allen, Ed. ASTM special technical publication 840. American Society of Testing Materials, Philadelphia, Pennsylvania.

Mackay, D., H. Puig and L.S. McCarty. 1992. An equation describing the time course and variability in uptake and toxicity of narcotic chemicals to fish. *Journal of Journal of Environmental Toxicology and Chemistry* 11:941–951.

MacKinnon, D.S. and P.A. Lane. 1993. *Saltmarsh revisited—The long-term effects of oil and dispersant on saltmarsh vegetation.* Environmental Studies Research Fund, Report No. 122. National Energy Board, Calgary, Alberta, Canada.

MacNaughton, S.J., R.P.J. Swannell, F. Daniel and L. Bristow. 2003. Biodegradation of dispersed Forties crude and Alaskan North Slope oils in microcosms under simulated marine conditions. *Spill Science and Technology Bulletin* 8(2):179–186.

Major, R.A., A.C.T. Chen and P. Nicholson. 1994. Wave basin tests of boat dispersant application systems. Pp 1035–1051 in *Proceedings of the Seventeenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia, Canada. Environment Canada. Ottawa, Ontario, Canada.

Malinky, G., and D.G. Shaw. 1979. Modeling the association of petroleum hydrocarbons and sub-arctic sediments. Pp. 621–623 in *Proceedings of the 1979 International Oil Spill Conference*, Los Angeles, California. American Petroleum Institute, Washington, D.C.

Marine and Freshwater Resources Institute. 1998. *Toxicity and effectiveness of the oil spill dispersant Corexit 9500.* Laboratory report. Marine and Freshwater Resources Institute, Queenscliff, Australia.

Masutani, S. and E. Adams. 2004. Liquid droplet contaminant plumes in the deep ocean. *Japanese Journal of Multiphase Flow* 18(2):135–152.

McAuliffe, C.D. 1963. Solubility in water of C1-C9 hydrocarbons. *Nature* 200:1092–1093.

McAuliffe, C.D. 1966. Solubility in water of paraffin, cycloparaffin, olefin, acetylene, cycloolefin, and aromatic hydrocarbons. *Journal of Physical Chemistry* 70:1267–1275.

McAuliffe, C.D. 1989. The weathering of volatile hydrocarbons from crude oil slicks on water. Pp. 357–364 in *Proceedings of the 1989 International Oil Spill Conference*, San Antonio, Texas. American Petroleum Institute, Washington, D.C.

McAuliffe, C.D., B.L. Steelman, W.R. Leek, D.E. Fitzgerald, J.P. Ray and C.D. Barker. 1981. The 1979 Southern California Dispersant Treated Research Oil Spills. Pp. 269–282 in *Proceedings of the 1981 International Oil Spill Conference*, Atlanta, Georgia. American Petroleum Institute, Washington, D.C.

McCarty, L.S. 1986. The relationship between aquatic toxicity QSARs and bioconcentration for some organic chemicals. *Journal of Environmental Toxicology and Chemistry* 5:1071–1080.

McCarty, L.S. and D. Mackay. 1993. Enhancing ecotoxicological modeling and assessment. *Environmental Science and Technology* 27(9):1719–1728.

McCarty, L.S., D. Mackay, A.D. Smith, G.W. Ozburn and D.G. Dixon. 1992. Residue-based Interpretation of Toxicity and Bioconcentration QSARs from Aquatic Bioassays: Neutral Narcotic Organics. *Journal of Environmental Toxicology and Chemistry* 11:917–930.

McDonagh, M. and K. Colcomb-Heiliger. 1992. Aerial spraying of demulsifiers to enhance the natural dispersion of oil slicks. Pp. 107–122 in *Proceedings of the Fifteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

McGrath, J.A., F.L. Hellweger, T.F. Parkerton and D.M. Di Toro. 2003. *Application of the Narcosis Target Lipid Model to Complex Mixtures Using Gasolines as a Case Study.* Paper presented at the Annual Meeting of the Society of Environmental Toxicology and Chemistry (SETAC), Austin, Texas. Society of Environmental Toxicology and Chemistry, Pensacola, Florida.

McGrath, J.A., T.F. Parkerton and D.M. DiToro. 2004. Application of the narcosis target lipid model to algal toxicity and deriving predicted no-effect concentrations. *Journal of Environmental Toxicology and Chemistry* 23:2503–2517.

McLean, J.D. and P.K. Kilpatrick. 1997a. Effects of asphaltene solvency on stability of water-in-crude-oil emulsions. *Journal of Colloidal and Interfacial Science* 189:242–255.
McLean, J.D. and P.K. Kilpatrick. 1997b. Effects of asphaltene aggregation in model heptane-toluene mixtures on stability of water-in-oil emulsions. *Journal of Colloid and Interface Science* 196:23–34.
McLean, J.D., P.M. Spiecker, A.P. Sullivan and P.K. Kilpatrick. 1998. The role of petroleum asphaltenes in the stabilization of water-in-oil emulsions. Pp. 377–422 in *Structure and Dynamics of Asphaltenes*, O.C. Mullins and E.Y. Sheu, Eds., Plenum Press, New York, New York.
McNaughton, S.J., R. Swannell, F. Daniel and L. Bristow. 2003. Biodegradation of dispersed Forties crude and Alaskan North Slope oils in microcosms under simulated marine conditions. *Spill Science and Technology Bulletin* 8:179–186.
Meeks, D.G. 1981. A view on the laboratory testing and assessment of oil spill dispersant efficiency. Pp. 19–29 in *Proceedings of the 1981 International Oil Spill Conference*, Atlanta, Georgia. American Petroleum Institute, Washington, D.C.
Menon, N.N. and N.R. Menon. 1999. Uptake of polycyclic aromatic hydrocarbons from suspended oil borne sediments by the marine bivalve *Sunetta scripta*. *Aquatic Toxicology* 45:63–69.
Michel, J. and C.B. Henry. 1997. Oil uptake and depuration in oysters after use of dispersants in shallow water in El Salvador. *Spill Science and Technology Bulletin* 4:57–70.
Michel, J., D. Scholz, S.R. Warren Jr. and A.H. Walker. 2004. *A Decision-Maker's Guide to* In-situ *Burning*. American Petroleum Institute, Washington, D.C.
Middaugh, D.P. and D.D. Whiting. 1995. Responses of embryonic and larval inland silversides, *Menidia beryllina*, to No.-2 Fuel-oil and oil dispersants in seawater. *Archives of Environmental Contamination and Toxicology* 29(4):535–539.
Miller, R.M. and R. Bartha. 1989. Evidence from liposome encapsulation for transport-limited microbial metabolism of solid alkanes. *Applied and Environmental Microbiology* 55(2):269–274.
Mitchell, F.M. and D.A. Holdaway. 2000. The acute and chronic toxicity of the dispersants Corexit 9527 and 9500, water accommodated fraction (WAF) of crude oil and dispersant enhanced WAF (DEWAF) to *Hydra viridissima* (green hydra). *Water Research* 34:343–348.
Miura, Y., M. Okazaki, S.-I. Hamada, S.-I. Murakawa and R. Yugen. 1977. Assimilation of liquid hydrocarbons by microorganisms. I. Mechanism of hydrocarbon uptake. *Biotechnology and Bioengineering* 19:701–714.
Moles, A., L. Holland and J. Short. 2002. Effectiveness in the laboratory of Corexit 9527 and 9500 in dispersing fresh, weathered, and emulsion of Alaska North Slope crude oil under subarctic conditions. *Spill Science and Technology Bulletin* 7(5-6):241–247.
Montgomery, D.C. 1997. *Design and Analysis of Experiments, Fourth Edition.* John Wiley & Sons, Incorporated. New York, New York.
Morales, R.A., A.J. Elliot and T. Lunel. 1997. The Influence of Tidal Currents and Wind on Mixing in the Surface Layers on the Sea. *Marine Pollution Bulletin* 34(1):15–25.
Mulkins-Phillips, G.J. and J.E. Stewart. 1974. Effect of four dispersants on biodegradation and growth of bacteria on crude oil. *Applied Microbiology* 28(4):547–552.
Mulyono, M., E. Jasjfi and M. Maloringan. 1994. Oil dispersants: do they do any good? Pp. 539–549 in *Proceeding of the Second International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production*, Jakarta, Indonesia. Society of Petroleum Engineers, Richardson, Texas.
Muschenheim, D.K. and K. Lee. 2002. Removal of oil from the sea surface through particulate interactions: review and prospectus. *Spill Science and Technology Bulletin* 8, 9–18.

National Oceanic and Atmospheric Administration (NOAA). 1994. *ADIOS, Automated Data Injury for Oil Spills, User's Manual.* NOAA/Hazardous Materials Response and Assessment Division, Seattle, Washington.

National Oceanic and Atmospheric Administration (NOAA). 1999. *Dispersant application observer job aid.* NOAA Hazardous Materials Response Division, Seattle, WA.

National Research Council (NRC). 1985. *Oil in the Sea: Inputs, Fates, and Effects.* National Academy Press, Washington, D.C.

National Research Council (NRC). 1989. *Using Oil Spill Dispersants on the Sea.* National Academy Press, Washington, D.C.

National Research Council (NRC) 1999. *Spills of Nonfloating Oils, Risks and Response.* National Academy Press, Washington, D.C.

National Research Council (NRC). 2003. *Oil in the Sea III: Inputs, Fates and Effects.* National Academies Press, Washington, D.C.

National Response Team Response Committee. 2002. *NRT-RRT Fact Sheet.* U.S. National Response Team, Washington, D.C. [Online] Available at: http://www.nrt.org/Production/NRT/NRTWeb.nsf/AllAttachmentsByTitle/A-58Riskcomm1/$File/riskcomm1.pdf?OpenElement [January 14, 2005].

Neff, J.M. 2002. *Bioaccumulation in Marine Organisms: Effect of Contaminants from Oil Well Produced Water.* Elsevier Science Publishers, Amsterdam, The Netherlands.

Neff, J.M. and Burns, W.A. 1996. Estimation of Polycyclic Aromatic Hydrocarbon Concentrations in the Water Column Based on Tissue Residues in Mussels and Salmon: An Equilibrium Partitioning Approach. *Journal of Environmental Toxicology and Chemistry* 15(12):2240–2253.

Neff, J.M. and W.E. Haensly. 1982. Long-term impact of the Amoco Cadiz crude oil spill on oysters *Crassostrea gigas* and plaice *Pleuronectes platessa* from Aber Benoit and Aber Wrac'h, Brittany, France. Pp. 269–327 in *Report of the NOAA-CNEXO Joint Scientific Commission, Ecological Study of Amoco Cadiz Oil Spill.* U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Boulder, Colorado.

Negri, A.P. and A.J. Heyward. 2000. Inhibition of fertilization and larval metamorphosis of the coral *Acropora millepora* (Ehrenberg, 1834) by petroleum products. *Marine Pollution Bulletin* 41:420–427.

New York Department of Health. 2005. *Glossary of Environmental Health Terms.* New York Department of State, New York, New York. [Online]. Available at: http://www.health.state.ny.us/nysdoh/consumer/environ/toxglos.htm [April 27, 2005].

Newsted, J.L. and J.P. Giesy. 1987. Predictive models for photoinduced acute toxicity of polycyclic aromatic hydrocarbons to *Daphnia magna*. *Journal of Environmental Toxicology and Chemistry* 6:445–461.

Nichols, J.A. and H.D. Parker. 1985. Dispersants: Comparison of laboratory tests and field trials with practical experience at spills. Pp. 421–427 in *Proceedings of the 1985 International Oil Spill Conference*, Los Angeles, California. American Petroleum Institute, Washington, D.C.

Nilsen, J., A. Naess and Z. Volent. 1985. *Measurements of oil concentrations in the water column, under breaking waves.* Report STF 60 A 85079, Norwegian Hydrotechnical Laboratory. SINTEF Trondheim, Norway.

Nirmalakhandan, N. and R.E. Speece. 1988. Structure-Activity Relationships, Quantitative Techniques for Predicting the Behavior of Chemicals in the Ecosystem. *Journal of Environmental Science Technology* 22(6):606–615.

Norwegian Institute for Water Research. 1994. *Marine algal growth inhibition test.* Laboratory Report. Norwegian Institute for Water Research, Oslo, Norway.

Nyman, J.A. 1999. Effect of crude oil and chemical additives on metabolic activity of mixed microbial populations in fresh marsh soils. *Microbial Ecology* 37:152–162.

Ohwada, K., M. Nishimura, M. Wada, H. Nomura, A. Shibata, K. Okamoto, K. Toyoda, A. Yoshida, H. Takada and M. Yamada. 2003. Study of the effect of water-soluble fractions of heavy-oil on coastal marine organisms using enclosed ecosystems, mesocosms. *Marine Pollution Bulletin* 47:78–84.

Ojo, T.O. and J.S. Bonner. 2002. Three-Dimensional Self-Calibrating Coastal Oil Spill Trajectory Tracking and Contaminant Transport using HF Radar. Pp. 215–226 in *Proceedings of Twenty-Fifth Arctic and Marine Oilspill Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada

Ojo, T.O., J.S. Bonner, C.A. Page, M. Sterling, C. Fuller and F.J. Kelly. 2003. Field simulation experiment of aerial dispersant application for spill of opportunity. Pp. 813–824 in *Proceedings of the Twenty-Sixth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Victoria, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Okubo, A. 1971. Oceanic diffusion diagrams. *Deep Sea Research* 18:789–802.

Omotoso, O.E., V.A. Munoz, R.J. Mikula. 2002. Mechanisms of crude oil–mineral interactions. *Spill Science and Technology Bulletin* 8(1):45–54.

Onishi, Y., D.S. Trent, T.E. Michener, J.E. Van Beek and C.A. Rieck. 1999. Simulation of Radioactive Tank Waste Mixing with Chemical Reactions, FEDSM99-7786. In *Proceedings of Third American Society of Mechanical Engineers/Japan Society of Mechanical Engineers (ASME/JSME) Joint Fluids Engineering Conference*, San Francisco, California. American Society of Mechanical Engineers, New York, New York.

Ordsie, C.J. and G.C. Garofalo. 1981. Lethal and sublethal effects of short term acute doses of Kuwait crude oil and a dispersant Corexit 9527 on bay scallops *Argopecten irradians* and two predators at different temperatures. *Marine Environmental Research* 5:195–210.

Osborn, T.R. 1974. Vertical profiling of velocity microstructure. *Journal of Physical Oceanography* 4:109–115.

Owens, E.H. and K. Lee. 2003. Interaction of oil and mineral fines on shorelines: Review and assessment. *Spill Science and Technology Bulletin* 47(9-12):397–405.

Pace, C.B. and J.R. Clark. 1993. *Evaluation of a toxicity test method used for dispersant screening in California.* MSRC Technical Report Series 93-028. Marine Spill Response Corporation, Washington, D.C.

Pace, C.B., J.R. Clark and G.E. Bragin. 1995. Comparing crude oil toxicity under standard and environmentally realistic exposures. Pp. 1003–1004 in *Proceedings of the 1995 International Oil Spill Conference*, Long Beach, California. American Petroleum Institute, Washington, D.C.

Page, C., P. Sumner, R. Autenrieth, J. Bonner and T. McDonald. 1999. Materials balance on a chemically dispersed oil and a whole oil exposed to an experimental beach front. Pp. 645–658 in *Proceedings of the Twenty-Second Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Page, C.A., J.S. Bonner, P.L. Sumner, T.J. McDonald, R.L. Autenrieth and C.B. Fuller. 2000a. Behaviour of a chemically-dispersed oil and a whole oil on a near-shore environment. *Water Research* 34:2507–2516.

Page, C.A., J.S. Bonner, P.L. Sumner and R.L. Autenrieth. 2000b. Solubility of petroleum hydrocarbons in oil/water systems. *Marine Chemistry* 70:79–87.

Page, C.A., R.L. Autenrieth, J.S. Bonner and T. McDonald. 2001. Behaviour of chemically dispersed oil in a wetland environment. Pp. 821–823 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Page, C.A., J.S. Bonner, T.J. McDonald and R.L. Autenrieth. 2002. Behavior of a chemically dispersed oil in a wetland environment. *Water Research* 36:3821–3833.

Parker, P.L. and S. Macko. 1978. An intensive study of the heavy hydrocarbons in the suspended particulate matter of seawater. Chapter 11 in *Environmental studies, south Texas*

outer continental shelf, biology and chemistry. BLM Contract AA550-CT7-11. U.S. Department of Interior, Bureau of Land Management (BLM), Washington, D.C.

Parker, C.A., M. Freegarde and C.G. Hatchard. 1971. The effect of some chemical and biological factors on the degradation of crude oil at sea. Pp. 237–244 in *Water Pollution by Oil*, P. Hepple, Ed. Institute of Petroleum, London, United Kingdom.

Payne, J.R. and A.A. Allen. 2004. *Use of natural oil seeps for evaluation of dispersant application and monitoring techniques.* Final report for Cooperative Institute for Coastal and Estuarine Environmental Technology /University of New Hampshire (UNH) Subcontract number 03-690. National Oceanic and Atmospheric Administration/UNH Cooperative Institute for Coastal and Estuarine Environmental Technology, Durham, New Hampshire. [Online] Available at: www.crrc.unh.edu. [April 22, 2005].

Payne, J.R. and A.A. Allen. In press. Use of natural oil seeps for evaluation of dispersant application and monitoring techniques. *Proceedings of the 2005 International Oil Spill Conference*, Miami Beach, Florida. American Petroleum Institute, Washington, D.C.

Payne, J.R. and W.B. Driskell. 2001. Source characterization and identification of New Carissa oil in NRDA environmental samples using a combined statistical and fingerprinting approach. Pp. 1403–1409 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Payne, J.R. and W.B. Driskell. 2003. The importance of distinguishing dissolved- versus oil-droplet phases in assessing the fate, transport, and toxic effects of marine oil pollution. Pp. 771–778 in *Proceedings of the 2003 International Oil Spill Conference*, Vancouver, Canada. American Petroleum Institute. Washington, D.C.

Payne, J.R. and French-McCay, D. 2001. *Development of a conceptual model for predicting pollutant movement from an oil spill with and without dispersant treatment: background information/literature review and oil spill modeling conceptualization.* Draft prepared for Environmental Protection Agency, Office of Research and Development, National Exposure Research Laboratory, Ecosystems Research Division. Environmental Protection Agency, Athens, Georgia.

Payne, J.R. and McNabb, G.D., Jr. 1984. Weathering of petroleum in the marine environment. *Marine Technology Society Journal* 18(3):24–40.

Payne, J.R. and C.R. Phillips. 1985a. Photochemistry of petroleum in water. *Environmental Science and Technology* 19(7):569–579.

Payne, J.R. and C.R. Phillips. 1985b. *Petroleum Spills in the Marine Environment: The Chemistry and Formation of Water-in-Oil Emulsions and Tar Balls.* Lewis Publishers, Incorporated, Chelsea, Michigan.

Payne, J.R., N.W. Flynn, P.J. Mankiewicz and G.S. Smith. 1980a. Surface evaporation/dissolution partitioning of lower-molecular-weight aromatic hydrocarbons in a down-plume transect from the IXTOC I wellhead. Pp. 119–166 in *Proceedings of the Symposium on Preliminary Results from the September 1979 Researcher/Pierce IXTOC-I Cruise*, Key Biscayne, Florida. National Oceanic and Atmospheric Administration Publications Office, Boulder, Colorado.

Payne, J.R., G.S. Smith, P.J. Mankiewicz, R.F. Shokes, N.W. Flynn, W. Moreno and J. Altamirano. 1980b. Horizontal and vertical transport of dissolved and particulate-bound higher-molecular-weight hydrocarbons from the IXTOC I blowout. Pp. 239–263 in *Proceedings of the Symposium on Preliminary Results from the September 1979 Researcher/Pierce IXTOC-I Cruise*, Key Biscayne, Florida. National Oceanic and Atmospheric Administration Publications Office, Boulder, Colorado.

Payne, J.R., B.E. Kirstein, G.D. McNabb Jr., J.L. Lambach, C. de Oliveira, R.E. Jordan and W. Hom. 1983. Multivariate analysis of petroleum hydrocarbon weathering in the subarctic marine environment. Pp. 423–434 in *Proceedings of the 1983 International Oil Spill Conference*, San Antonio, Texas. American Petroleum Institute, Washington, D.C.,

Payne, J.R., B.E. Kirstein, G.D. McNabb, Jr., J.L. Lambach, R. Redding, R.E. Jordan, W. Hom, C. de Oliveira, G.S. Smith, D.M. Baxter and R. Geagel. 1984. Multivariate analysis of petroleum weathering in the marine environment—subarctic. Volume I, Technical Results; Volume II, Appendices in *Outer Continental Shelf Environmental Assessment Program, Final Reports of Principal Investigators, Volume 21 and 22*. Volume 21 NTIS Accession Number PB85-215796; Volume 22 NTIS Accession Number PB85-215739. Report to the U.S. Department of Commerce. National Oceanic and Atmospheric Administration, Ocean Assessment Division, Juneau, Alaska.

Payne, J.R., B.E. Kirstein, J.R. Clayton, Jr., C. Clary, R. Redding, Jr., G.D. McNabb and G.H. Farmer. 1987a. *Integration of suspended particulate matter and oil transportation study.* Final Report submitted to Minerals Management Service. Minerals Management Service, Environmental Studies Branch, Anchorage, Alaska.

Payne, J.R., C.R. Phillips and W. Hom. 1987b. Transport and Transformations: Water Column Processes. Pp. 175–232 in *Long Term Environmental Effects of Offshore Oil and Gas Development*, D.F. Boesch and N.N. Rabelais, Eds. Elsevier Applied Science, New York, New York.

Payne, J.R., G.D. McNabb, Jr., L.E. Hachmeister, B.E. Kirstein, J.R. Clayton, Jr., C.R. Phillips, R.T. Redding, C.L. Clary, G.S. Smith and G.H. Farmer. 1987c. Development of a Predictive Model for the Weathering of Oil in the Presence of Sea Ice. Pp. 147–465 in *Outer Continental Shelf Environmental Assessment Program, Final Reports of Principal Investigators*. NTIS Accession Number PB-89-159776. Report to the U.S. Department of Commerce. National Oceanic and Atmospheric Administration, Ocean Assessment Division, Juneau, Alaska.

Payne, J.R., J.R. Clayton, Jr., G.D. McNabb, Jr., B.E. Kirstein, C.L. Clary, R.T. Redding, J.S. Evans, E. Reimnitz and E.W. Kempema. 1989. Oil-Ice-Sediment Interactions During Freezeup and Breakup. Pp. 1–382 in *Outer Continental Shelf Environmental Assessment Program, Final Reports of Principal Investigators*. NTIS Accession Number PB-90-156217. Report to the U.S. Department of Commerce. National Oceanic and Atmospheric Administration, Ocean Assessment Division, Juneau, Alaska.

Payne, J.R., J.R. Clayton, Jr., G.D. McNabb, Jr. and B.E. Kirstein. 1991a. Exxon Valdez oil weathering fate and behavior: Model predictions and field observations. Pp. 641–654 in *Proceedings of the 1991 International Oil Spill Conference*, San Diego, California. American Petroleum Institute, Washington, D.C.

Payne, J.R., G.D. McNabb, Jr. and J.R. Clayton, Jr. 1991b. Oil-weathering behavior in arctic environments. *Polar Research* 10(2):631–662.

Payne, J.R., J.R. Clayton, Jr., C.R. Phillips, J. Robinson, D. Kennedy, J. Talbot, G. Petrae, J. Michel, T. Ballou and S. Onstad. 1991c. Dispersant trials using the Pac Baroness, a spill of opportunity. Pp. 427–433 in *Proceedings of the 1991 International Oil Spill Conference*, San Diego, California. American Petroleum Institute, Washington, D.C.

Payne, J.R., L.E. Hachmeister, G.D. McNabb, Jr., H.E. Sharpe, G.S. Smith and C.A. Manen. 1991d. Brine-induced advection of dissolved aromatic hydrocarbons to arctic bottom waters. *Environmental Science and Technology* 25(5):940–951.

Payne, J.R., T.J. Reilly, R.J. Martrano, G.P. Lindblom, M.C. Kennicutt II and J.M. Brooks. 1993. Spill-of-opportunity testing of dispersant effectiveness at the Mega Borg oil spill. Pp. 791–793 in *Proceedings of the 1993 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Payne, J.R., T.J. Reilly and D.P. French-McCay. 1999. Fabrication of a portable large-volume water sampling system to support oil spill NRDA efforts. Pp. 1179–1184 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Payne, J.R., J.R. Clayton, Jr. and B.E. Kirstein. 2003. Oil/suspended particulate material interactions and sedimentation. *Spill Science & Technology* 8(2):201–221.

Peakall, D.B., P.G. Wells and D. Mackay. 1987. A hazard assessment of chemically dispersed oil spills and seabirds. *Marine Environmental Research* 22:91–106.

Pelletier, M.C., R.M. Burgess, K.T. Ho, A. Kuhn, R.A. McKinney and S.A. Ryba. 1997. Phototoxicity of individual polycyclic aromatic hydrocarbons and petroleum to marine invertebrate larvae and juveniles. *Journal of Environmental Toxicology and Chemistry* 16:2190–2199.

Peters, E.C., P.A. Meyers, P.P. Yevich and N.J. Blake. 1981. Bioaccumulation and histopathological effects of oil on a stony coral. *Marine Pollution Bulletin* 12(10):333–339.

Peters, E.C., N.J. Gassman, J.C. Firman, R.H. Richmond and E.A. Power. 1997. Ecotoxicology of tropical marine ecosystems. *Environmental Toxicology and Chemistry* 16(1):12–40.

Pezeshki, S.R., M.W. Hester, Q. Lin and J.A. Nyman. 2000. The effects of oil spill and cleanup on dominant US Gulf coast marsh macrophytes: a review. *Environmental Pollution* 108(2):129–139.

Pittinger, C.A., R. Bachman, A.L. Barton, J.R. Clark, P.L. deFur, S.J. Ellis, M.W. Slimak, R.G. Stahl and R.S. Wentzel. 1998. A multi-stakeholder framework for ecological risk assessment—Summary of a SETAC technical workshop. Pp. 23–25 in *Summary of SETAC Workshop on Framework for Ecological Risk Management*, Williamsburg, Virginia. Society of Environmental Toxiciology and Chemistry, Pensacola, Florida.

Pollino, C.A. and D.A. Holdaway. 2002a. Reproductive potential of crimson-spotted rainbowfish (*Melanotaenia fluviatilis*) following short-term exposure to bass strait crude oil and dispersed crude oil. *Environmental Toxicology* 17:138–145.

Pollino, C.A. and D.A. Holdaway. 2002b. Toxicity testing of crude oil and related compounds using early life stages of the crimson-spotted rainbowfish (*Melanotaenia fluviatilis*). *Ecotoxicology and Environmental Safety* 52:180–189.

Pollino, C.A. and D.A. Holdaway. 2003. Hydrocarbon-induced changes to metabolic and detoxification enzymes of the Australian Crimson-Spotted rainbowfish (*Melanotaenia fluviatilis*). *Environmental Toxicology* 18:21–28.

Pond, R., J.H. Kucklick and A.H. Walker. 1997. *Dispersant use: Real-time operational monitoring and long-term data gathering.* Prepared by Scientific and Environmental Associates, Incorporated for the Marine Preservation Association. Marine Preservation Association, Scottsdale, Arizona.

Pond, R.G., D.V. Aurand and J.A. Kraly (compilers). 2000. *Ecological Risk Assessment Principles Applied to Oil Spill Response Planning in the Galveston Bay Area.* Texas General Land Office, Austin, Texas.

Poremba, K. 1993. Influence of synthetic and biogenic surfactants on the toxicity of water-soluble fractions of hydrocarbons in sea water determined with the bioluminescence inhibition test. *Environmental Pollution* 80:25–29.

Poremba, K. and W. Gunkel. 1990. Marine Biosurfactants, III. Toxicity Testing with Marine Microorganisms and Comparison with Synthetic Surfactants. *Verlag der Zeitschrift fur Naturforschung* 46c:210–216.

Porter, M.R. 1991. *Handbook of Surfactants.* Blackie and Sons, Ltd., Glasgow, Scotland.

Prince William Sound Regional Citizens' Advisory Council (PWSRCAC). 2004. *Heated oil and under-reported dispersant volumes MAR MMS/Exxon cold water dispersant tests at OHMSETT.* Report prepared by the PWSRCAC. Prince William Sound Regional Citizens' Advisory Council, Anchorage, Alaska.

Proctor, R., A. Elliot and R. Flather. 1994. Forecast and hindcast simulations of the Braer oil-spill. *Marine Pollution Bulletin* 28(4):219–229.

Proctor, R., R. Flather, A. Roger and A.J. Elliott. 1994. Modeling tides and surface drift in the Arabian Gulf—application to the Gulf oil spill. *Continental Shelf Research* 14(5):531–545.

Ramachandran, S.D., P.V. Hodson, C.W. Khan and K. Lee. 2003. PAH uptake by juvenile rainbow trout exposed to dispersed crude oil. Pp. 743–754 in *Proceedings of the Twenty-*

Sixth Arctic and Marine Oilspill Program (AMOP) Technical Seminar, Victoria, British Columbia, Canada. Environment Canada, Ottawa, Ontario, Canada.

Ramachandran, S.D., C.W. Khan, P.V. Hodson, K. Lee and T. King. 2004. Role of droplets in promoting uptake of PAHs by fish exposed to chemically dispersed crude oil. Pp. 765–772 in *Proceedings of the Twenty-Seventh Arctic Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Rand, G.M., Ed. 1995. *Fundamentals of aquatic toxicology: Effects, environmental fate, and risk assessment.* CRC Press, Incorporated, Boca Raton, Florida.

Reddy, P.G., H.D. Singh, M.G. Pathak, S.D. Bhagat and J.N. Baruah. 1983. Isolation and functional characterization of hydrocarbon emulsifying and solubilizing factors produced by a *Pseudomonas* species. *Biotechnology and Bioengineering* 25:387–401.

Reed, M., D. French-McCay, S. Feng and W. Knauss. 1991. A Three-Dimensional Natural Resource Damage Assessment and Coupled Geographical Information System. Pp. 631–637 in *Proceedings of 1991 National Conference of the American Society of Civil Engineers (ASCE) Hydraulic Engineering*, Nashville, Tennessee. American Society of Civil Engineers, Reston, Virginia.

Reed, M., O. Johansen, P.J. Brandvik, P. Daling, A. Lewis, R. Fiocco, D. Mackay and R. Prentki. 1999. Review: Oil Spill Modeling Toward the Close of the 20th Century: Overview of the State of the Art. *Spill Sciences and Technology Bulletin* 5(1):3–16.

Reed, M., P.S. Daling, A. Lewis, M.K. Ditlevsen, B. Brørs, J. Clark and D. Aurand. 2004. Modeling of Dispersant Application to Oil Spills in Shallow Coastal Waters. *Environmental Modeling and Software* 19(7-8):681–690.

Rewick, R.T., K.A. Sabo, J. Gates, J.H. Smith and L.T. McCarthy. 1981. An evaluation of oil spill dispersant testing requirements. Pp. 5–10 in *Proceedings of the 1981 International Oil Spill Conference*, Atlanta, Georgia. American Petroleum Institute, Washington, D.C.

Rhoton, S.L., R.A. Perkins, J.F. Braddock and C. Behr-Andres. 2001. A cold-weather species' response to chemically dispersed fresh and weathered Alaska North Slope crude oil. Pp. 1231–1236 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Ritchie, W. and M. O'Sullivan. 1994. *The environmental impact of the wreck of the Braer.* The Scottish Office, Edinburgh, Scotland.

Rogers, R.D., J.C. McFarlane and A.J. Cross. 1980. Adsorption and desorption of benzene in two soils and montmorillonite clay. *Environmental Science and Technology* 14:457–461.

Rosenberg, M. and E. Rosenberg. 1981. Role of adherence in growth of *Acinetobacter calcoaceticus* RAG-1 on hexadecane. *Journal of Bacteriology* 148(1):51–57.

Ross, S. and R. Belore. 1993. Effectiveness of dispersants on thick oil slicks. Pp. 1011–1022 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Ross, S. and I. Buist. 1995. Preliminary laboratory study to determine the effect of emulsification on oil spill evaporation. Pp. 91–312 in *Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Ruxton, G.D. and N. Colegrave. 2003. *Experimental Design for the Life Sciences.* Oxford University Press, Incorporated, New York, New York.

Schippers, C., K. Gebner, T. Muller and T. Scheper. 2000. Microbial degradation of phenanthrene by addition of a sophorolipid mixture. *Journal of Biotechnology* 83:189–198.

Schlautman, M.A. and J.J. Morgan. 1993. Effects of aqueous chemistry on the binding of polycyclic aromatic hydrocarbons by dissolved humic materials. *Environmental Science and Technology* 27(5):961–969.

Schroh, K. 1995. Advanced aerial surveillance system for detection of marine pollution and international aerial surveillance cooperation in the North and Baltic Seas. Pp. 21–26 in

Proceedings of the 1995 International Oil Spill Conference, Long Beach, California. American Petroleum Institute, Washington, D.C.

Schwarzenbach, R.P., P.M. Gschwend and D.M. Imaboden. 1993. Pp. 436–484 in *Environmental Organic Chemistry*. Wiley Interscience, New York, New York.

Sea Empress Environmental Evaluation Committee (SEEEC). 1996. *Sea Empress Environmental Evaluation Committee (SEEEC) Initial Report.* SEEEC Secretariat, Cardiff, Wales, United Kingdom.

Shafir, S., J.V. Rijnb and B. Rinkevicha. 2003. The use of coral nubbins in coral reef ecotoxicology testing. *Biomolecular Engineering* 20(4-6):401–406.

Shigenaka, G. 2001. *Toxicity of Oil to Reef-Building Corals: A Spill Response Perspective.* NOAA Technical Memorandum NOA OR&R 8. National Oceanic and Atmospheric Administration, Hazardous Materials Response Division, Seattle, Washington.

Short, J.W. and P.M. Harris. 1996. Chemical sampling and analysis of petroleum hydrocarbons in near-surface seawater of Prince William Sound after the Exxon Valdez oil spill. *American Fisheries Society Symposium* 18:17–28.

Sigman, M.E., P.F. Schuler, M.M. Gosh and R.T. Dabestani. 1998. Mechanism of Pyrene Photochemical Oxidation in Aqueous and Surfactant Solutions. *Environmental Science and Technology* 32:3980–3985.

Simecek-Beatty, D., C. O'Conner and W.J. Lehr. 2002. 3-D Modeling of Chemically Dispersed Oil. Pp. 1149–1159 in *Proceedings of Twenty-Fifth Arctic and Marine Oilspill Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Singer, M.E. and W.R. Finnerty. 1984. Microbial metabolism of straight-chain and branched alkanes. Pp. 1–59 in *Petroleum Microbiology*, R.M. Atlas, Ed. Macmillan Publishing Company, New York, New York.

Singer, M.M., D.L. Smalheer, R.S. Tjeerdema and M. Martin. 1990. Toxicity of an oil dispersant to the early life stages of four California marine species. *Journal of Environmental Toxicology and Chemistry* 9:1389–1397.

Singer, M., D.L. Smalheer, R.S. Tjeerdema and M. Martin. 1991. Effects of spiked exposure to an oil dispersant on the early life stages of four marine species. *Journal of Environmental Toxicology and Chemistry* 10:1367–1374.

Singer, M.M., S. George, D. Benner, S. Jacobson, R.S. Tjeerdema and M.L. Sowby. 1993. Comparative toxicity of 2 oil dispersants to the early-life stages of 2 marine species. *Journal of Environmental Toxicology and Chemistry* 12(10):1855–1863.

Singer, M.M., S. George, S. Jacobson, I. Lee, R.S. Tjeerdema and M.L. Sowby. 1994a. Comparative effects of oil dispersants to the early-life stages of topsmelt (*Atherinops-affinis*) and kelp (*Macrocystis-pyrifera*). *Journal of Environmental Toxicology and Chemistry* 13(4): 649–655.

Singer, M.M., S. George, S. Jacobson, I. Lee, R.S. Tjeerdema and M.L. Sowby. 1994b. Comparative toxicity of Corexit(R)-7664 to the early-life stages of 4 marine species. *Archives of Environmental Contamination and Toxicology* 27(1):130–136.

Singer, M.M., S. George and R.S. Tjeerdema. 1995. Relationship of some physical-properties of oil dispersants and their toxicity to marine organisms. *Archives of Environmental Contamination and Toxicology* 29(1):33–38.

Singer, M.M., S. George, S. Jacobson, I. Lee, L.L. Weetman, R.S. Tjeerdema and M.L. Sowby. 1996. Comparison of acute aquatic effects of the oil dispersant Corexit 9500 with those of other Corexit series dispersants. *Ecotoxicology and Environmental Safety* 35(2):183–189.

Singer, M.M., S.George, I. Lee, S. Jacobson, L.L. Weetman, G. Blondina, R.S. Tjerdeema, D. Aurand and M.L. Sowby. 1998. Effects of dispersant treatment on the acute toxicity of petroleum hydrocarbons. *Archives of Environmental Contamination and Toxicology* 34(2): 177–87.

Singer, M.M., D. Aurand, G.E. Bragins, J.R. Clark, G.M. Coelho, M.L. Sowby and R.S. Tjeerdema. 2000. Standardization of the preparation and quantitation of water-accommodated fractions of petroleum for toxicity testing. *Marine Pollution Bulletin* 40(11):1007–1016.

Singer, M.M., D. Aurand, G. Coelho, G.E. Bragin, J.R. Clark, S. Jacobson, M.L. Sowby and R.S. Tjeerdema. 2001a. Making, measuring, and using water-accommodated fractions of petroleum for toxicity testing. Pp. 1269–1274 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Singer, M.M., S. Jacobson, R.S. Tjeerdema and M.L. Sowby. 2001b. Acute effects of fresh versus weathered oil to marine organisms: California findings. Pp. 1263–1268 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Sjoblom, J., N. Aske, I.H. Auflem, O. Brandal, T.E. Harve, O. Saether, A. Westvik, E.E. Johnsen and H. Kallevik. 2003. Our current understanding of water-in-crude oil emulsions. Recent characterization techniques and high pressure performance. *Advances in Colloid and Interface Science* 100-102:399–473.

Slade, G.J. 1982. Effect of Ixtoc I crude oil and Corexit® 9527 on spot (*Leiostomus xanthurus*) egg mortality. *Bulletin of Environmental Contamination and Toxicology* 29:525–530.

S.L. Ross. 1997. *A review of dispersant use on spills of North Slope crude oil in Prince William Sound and the Gulf of Alaska.* Report No. C\634.96.1. Report by S.L. Ross Environmental Research Ltd. for Prince William Sound Regional Citizens' Advisory Council, Anchorage, Alaska.

S.L. Ross. 2000. *Feasibility of using OHMSETT for dispersant testing.* Report to the MAR, Incorporated. MAR, Incorporated, Atlantic Highlands, New Jersey.

S.L. Ross. 2002. *Dispersant Effectiveness Testing in Cold Water.* Report by S.L. Ross Environmental Research Ltd. for the Minerals Management Service and ExxonMobil Research and Engineering Company. S.L. Ross, Ottawa, Ontario Canada.

S.L. Ross and MAR Incorporated. 2003. *Dispersant Effectiveness Testing on Alaskan Oils in Cold Water.* Report by S.L. Ross Environmental Research Ltd. and MAR Incorporated for the Minerals Management Service. S.L. Ross, Ottawa, Ontario, Canada; MAR Incorporated, Leonardo, New Jersey.

Smith, C.J., R.D. Delaune, W.H. Patrick, Jr. and J.W. Fleeger. 1984. Impact of dispersed and undispersed oil entering a Gulf Coast salt marsh. *Journal of Environmental Toxicology and Chemistry* 3(4):609–616.

Smith, J.E. 1968. *Torrey Canyon Pollution and Marine Life.* Cambridge University Press, New York, New York.

Society of Environmental Toxicology and Chemistry (SETAC). 2003. *Population-Level Ecological Risk Assessment.* Workshop held in Roskilde, Denmark, 23–27 August 2003. SETAC, Pensacola, Florida.

Socolofsky, S.A. and E.E. Adams. 2002. Multi-phase plumes in uniform and stratified crossflow. *Journal of Hydraulic Research*, 40(6):661–672.

Sorial, G.A., K.M. Koran, E. Holder, A.D. Venosa and D.W. King. 2001. Development of a rational oil spill dispersant effectiveness protocol. Pp. 471–478 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Sorial, G.A., A.D. Venosa, K.M. Koran, E. Holder and D.W. King. 2004a. Oil spill dispersant effectiveness protocol. I: Impact of operational variables. *Journal of Environmental Engineering* 130:1073–1084.

Sorial, G.A., A.D. Venosa, K.M. Koran, E. Holder and D.W. King. 2004b. Oil spill dispersant effectiveness protocol. II: Performance of revised protocol. *Journal of Environmental Engineering* 130:1085–1093.

Spaulding, M. 1988. A state-of-the-art review of oil spill trajectory and fate modeling. *Oil and Chemical Pollution* 4:39–55.

Spaulding, M.L., E. Howlett, E.L. Anderson and K. Jayko. 1992. OILMAP: A Global Approach to Spill Modeling. Pp. 15–21 in *Proceedings of the Fifteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Spaulding, M., V. Kolluru, E. Anderson and E. Howlett. 1994. Application of a 3-dimensional oil spill model to hindcast the Braer spill. *Spill Science and Technology Bulletin* 1(1):23–35.

Speight, J.G. 1991. *The Chemistry and Technology of Petroleum.* Marcel Dekker, Incorporated, New York, New York.

Stephens, F.L., J.S. Bonner, R.L. Autenrieth and T.J. McDonald. 1999. TLC/FID analysis of compositional hydrocarbon changes associated with bioremediation. Pp. 219–224 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Stephenson, R. 1997. Effects of oil and other surface-active organic pollutants on aquatic birds. *Environmental Conservation* 24:121–129.

Stephenson, R. and C.A. Andrews. 1997. The effect of water surface tension on feather wettability in aquatic birds. *Canadian Journal of Zoology* 74:288–294.

Sterling, M.C., J.S. Bonner, C.A. Page, C.B. Fuller, A.N.S. Ernest and R.L Autenrieth. 2003. Partitioning of crude oil polycyclic aromatic hydrocarbons in aquatic systems. *Environmental Science and Technology* 37:4429–4434.

Sterling, M.C., Jr., J.S. Bonner, A.N.S. Ernest, C.A. Page and R.L. Autenrieth. 2004a. Characterizing aquatic sediment-oil aggregates using *in-situ* instruments. *Marine Pollution Bulletin* 48:533–542.

Sterling, M.C., Jr., J.S. Bonner, C.A. Page, C.B. Fuller, A.N.S. Ernest and R.L. Autenrieth. 2004b. Modeling crude oil droplet-sediment aggregation in nearshore waters. *Environmental Science and Technology* 38:4627–4634.

Sterling, M.C., J.S. Bonner, A.N.S. Ernest, C.A. Page and R.L. Autenrieth. 2004c. Chemical dispersant effectiveness testing: influence of droplet coalescence. *Marine Pollution Bulletin* 48:969–977.

Stevens, L. and J. Roberts. 2003. Dispersant effectiveness on heavy fuel oil and crude oil in New Zealand. Pp. 1–5 in *Proceedings of the 2003 International Oil Spill Conference*, Vancouver, Canada. American Petroleum Institute. Washington, D.C.

Stiver, W. and D. Mackay. 1984. Evaporation rate of oil spills of hydrocarbons and petroleum mixtures. *Environmental Science and Technology* 18:834–840.

Stoermer, S., G. Butler, C. Henry. 2001. Application of Dispersants to Mitigate Oil Spills in the Gulf of Mexico: The Poseidon Pipeline Spill Case Study. Pp. 1227–1299 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Stoffyn-Egli, P. and K. Lee. 2002. Observation and characterization of oil–mineral aggregates. *Spill Science and Technology* 8(1):31–44.

Stolzenbach, K.D., O.S. Madsen, E.E. Adams, A.M. Pollack and C.K. Cooper. 1977. *A Review and Evaluation of Basic Techniques Predicting the Behavior of Surface Oil Slicks.* Report No. 222 of the Ralph M. Parsons Laboratory for Water Resources and Hydrodynamics. Massachusetts Institute of Technology, Cambridge, Massachusetts.

Strom-Kristiansen, T., P.S. Daling, A. Lewis and A.B. Nordvik. 1994. *Weathering properties and chemical dispersibility of crude oils transported in U.S. waters.* Technical Report Series 93-032. Marine Spill Response Corporation, Washington, D.C.

Strom-Kristiansen, T., P.S. Daling, P.J. Brandvik and H. Jensen. 1995. Mechanical recovery of chemically-treated oil slicks. Pp. 407–421 in *Proceedings of the Nineteenth Arctic and Ma-*

rine Oilspill Program (AMOP) Technical Seminar, Calgary, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Subba-Rao and M. Alexander. 1982. Effects of sorption on mineralization of low concentrations of aromatic hydrocarbons in lake water. *Applied Environmental Microbiology* 44:659–668.

Suter, G.W., II. 1993. *Ecological Risk Assessment.* Lewis Publishers, Boca Raton, Florida.

Sutton, C. and J.A. Calder. 1974. Solubility of higher-molecular-weight n-paraffins in distilled water and seawater. *Environmental Science and Technology* 8:654–657.

Sutton, C. and J.A. Calder. 1975a. Reply to correspondence to the editor. *Environmental Science and Technology* 9:354–6.

Sutton, C. and J.A. Calder. 1975b. Solubility of alkylbenzenes in distilled water and seawater at 25.0° C. *Journal of Chemical and Engineering Data* 20(3):320–322.

Swannell, R.P.J. and F. Daniel. 1999. Effect of dispersants on oil biodegradation under simulated marine conditions. Pp. 166–176 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Swannell, R.J.P., F. Daniel, B.C. Croft, M.A. Englehardt, S. Wilson, D.J. Mitchell and T. Lunel. 1997. Influence of physical and chemical dispersion on the biodegradation of oil under simulated marine conditions. Pp. 617–641 in *Proceedings of the Twentieth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Vancouver, British Columbia. Environment Canada, Ottawa, Ontario, Canada.

Swartz, R.C., D.W. Schults, R.O. Ozretich, J.O. Lamberson, F.A. Cole, T.H. DeWitt, M.S. Redmond and S.P. Ferraro. 1995. S PAH: A model to predict the toxicity of polynuclear aromatic hydrocarbon mixtures in field collected sediments. *Journal of Environmental Toxicology and Chemistry* 14:1977–1987.

Tang, L. 2004. Cylindrical liquid-liquid jet instability. Ph.D. Dissertation, University of Hawaii, Manoa.

Tasaki, R. and A. Ogawa. 1999. Emulsification of crude oil: A new equation and governing parameters. Pp. 1011–1014 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Tennekes, H. and J.L. Lumley. 1972. *A First Course in Turbulence.* Massachusetts Institute of Technology Press, Cambridge, Massachusetts.

Terray, E.A., M.A. Donelan, Y.C. Agrawal, W.M. Drennan, K.K. Kahma, A.J. Williams, III, P.A. Hwang and S.A. Kitaigorodskii. 1996. Estimates of kinetic energy dissipation under breaking waves. *Journal of Physical Oceanography* 26:792–807.

Thomas, D. and T. Lunel. 1993. The *Braer* incident: Dispersion in action. Pp. 843-859 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Thorhaug, A., K. Aiken, M. Anderson, B. Carby, V. Gordon, F. McDonald, J. McFarlane, B. Miller, R. Reese, M. Rodriquez, G. Sidrak, H. Teas and W. Walker. 1989. Dispersant Use for Tropical Nearshore Waters: Jamaica. Pp. 415-418 in *Proceedings of the 1989 International Oil Spill Conference*, San Antonio, Texas. American Petroleum Institute, Washington, D.C.

Transtronics. 2000. *Viscosity.* Transtronics, Lawrence, Kansas. [Online] Available at: http://xtronics.com/reference/viscosity.htm [January 18, 2005].

Traxler, R.W. and L.S. Bhattacharya. 1978. Effect of a chemical dispersant on microbial utilization of petroleum hydrocarbons. Pp. 181–187 in *Chemical Dispersants for the Control of Oil Spills*, L.T. McCarthy, G.P. Lindblom and H.F. Walter, Eds. American Society for Testing and Materials. Philadelphia, Pennsylvania.

Trudel, B.K, Ed. 1998. *Dispersant Use in Alaska: A Technical Update*, Conference Proceedings. Prince William Sound Oil Spill Recovery Institute, Cordova, Alaska.

Trudel, K. 2002. *Lecture Notes, Oil Spill Dispersant Course for Supervisors.* S.L. Ross Environmental Research, Ottawa, Ontario, Canada, Unpublished.

Tsahalis, D.T. 1979. Contingency Planning for Oil Spills: RiverSpill—A River Simulation Model. Pp. 27–36 in *Proceedings of the 1979 International Oil Spill Conference*, Los Angeles, California. American Petroleum Institute, Washington, D.C.

Twardus, E.M. 1980. *A Study to Evaluate the Combustibility and Other Physical and Chemical Properties of Aged Oils and Emulsions.* Report of Environment Canada, Research and Development Division, Environmental Emergency Branch, Environmental Impact Control Directorate, Environmental Protection Service, Ottawa, Ontario, Canada.

Underwood, A.J. 1994. On beyond BACI: Sampling designs that might reliably detect environmental disturbances. *Ecological Applications* 4(1):3–15.

Unsal, M. 1991. Comparative toxicity of crude-oil, dispersant and oil-dispersant mixture to prawn *Palaemon-elegans*. *Toxicology and Environmental Chemistry* 31-2:451–459.

U.S. Coast Guard, National Oceanic and Atmospheric Administration, Environmental Protection Agency, Centers for Disease Control and Prevention and Minerals Management Service. 2001. *Special monitoring of applied response technologies (SMART).* U.S. Coast Guard, Washington, D.C. [Online] Available at: http://response.restoration.noaa.gov/oilaids/SMART/SMART.html [March 17, 2005].

Valiela I. 1984. Marine Ecological Processes. Springer-Verlag, New York, Inc.

Van Hamme, J.D. and O.P. Ward. 1999. Influence of chemical surfactants on the biodegradation of crude oil by a mixed bacterial culture. *Canadian Journal of Microbiology* 45:130–137.

Van Hamme, J.D. and O.P. Ward. 2001. Physical and metabolic interactions of Pseudomonas sp strain JA5-B45 and Rhodococcus sp strain F9-D79 during growth on crude oil and effect of a chemical surfactant on them. *Applied and Environmental Microbiology* 67(10): 4874–4879.

van Loosdrecht, M.C.M., J. Lyklema, W. Norde and A.J.B. Zehnder. 1990. Influence of interfaces on microbial activity. *Microbiolological Reviews* 54:75–87.

van Wezel, A., D. de Vries, D. Sijm and A. Opperhuizen. 1996. Use of the lethal body burden in the evaluation of mixture toxicity. *Ecotoxicology and Environmental Safety* 35:236–241.

Vandermeulen, J.H. 1980. Chemical dispersion of oil in coastal low-energy systems: saltmarshes and Tidal Rivers. Pp. 27–29 in *Chemical Dispersion of Oil Spills: An International Research Symposium*, D. Mackay, P.G. Wells and S. Paterson, Eds. Publication number EE-17. University of Toronto, Toronto, Ontario, Canada.

Varadaraj, R., M.L. Robbins, J. Bock, S. Pace and D. MacDonald. 1995. Dispersion and biodegradation of oil spills on water. Pp. 101–106 in *Proceedings of the 1995 International Oil Spill Conference*, Long Beach, California. American Petroleum Institute, Washington, D.C.

Varhaar, H.J.M, C.J. VanLeeuwen and J.L.M. Hermens. 1992. Classifying Environmental Pollutants, 1: Structure-activity Relationships for Prediction of Aquatic Toxicity. *Chemosphere* 25:471–491.

Venosa, A.D., G.A. Sorial, T.L. Richardson, F. Uraizee and M.T. Suidan. 1999. Research leading to revisions in EPA's dispersant effectiveness protocol. Pp. 1019–1022 in *Proceedings of the 1999 International Oil Spill Conference*, Seattle, Washington. American Petroleum Institute, Washington, D.C.

Venosa, A.D., G.A. Sorial and D.W. King. 2001. Round-robin testing of a new EPA dispersant effectiveness protocol. Pp. 467–470 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Venosa, A.D., D.W. King and G.A. Sorial. 2002. The baffled flask test for dispersant effectiveness: a round robin evaluation of reproducibility and repeatability. *Spill Science and Technology Bulletin* 7(5-6):299–308.

Veron, F. and W.K. Melville. 2001. Pulse-to-pulse coherent Doppler measurements of waves and turbulence. *Journal of Atmospheric and Oceanic Technology* 16(11):1580–1597.

Volkman, J.K., G.J. Miller, A.T. Revill and D.W. Connell. 1994. Oil spills, Part 6. Pp. 509–695 in *Environmental Implications of Offshore Oil and Gas Development in Australia—The Findings of an Independent Scientific Review*, J.M. Swan, J.M. Neff and P.C. Young, Eds. Australian Petroleum Exploration Association (APEA) and Energy Research and Development Corporation (ERDC), Sydney, Australia.

Wade, T.L. and J.G. Quinn. 1980. Incorporation, distribution and fate of saturated petroleum hydrocarbons in sediments from a controlled marine ecosystem. *Marine Environmental Research* 3:15–33.

Walker, A.H. and D.R. Henne. 1991. The Region III Regional Response Team technical symposium on dispersants: An interactive, educational approach to enlightened decision making. Pp. 405–410 in *Proceedings of the 1991 International Oil Spill Conference*, San Diego, California. American Petroleum Institute, Washington, D.C.

Walker, M.I. and T. Lunel. 1995. Response to oil spills at sea using both demulsifiers and dispersants. Pp. 537–558 in *Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Walker, A.H., D.L. Ducey, Jr., J.R. Gould and A.B. Nordvik, Eds. 1993a. *Formation and Breaking of Water-in-Oil Emulsions: Workshop Proceedings.* Marine Spill Response Corporation, Washington, D.C.

Walker, M., M. McDonaugh, D. Albone, S. Grigson, A. Wilkinson and G. Baron. 1993b. Comparison of observed and predicted changes to oil after spills. Pp. 389–393 in *Proceedings of the 1993 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Walker, A.H., T. Lunel, P.J. Brandvik and A. Lewis. 1995. Emulsification processes at sea—Forties crude oil. Pp. 471–491 in *Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Ward, G.A., B. Baca, W. Cyriacks, R.E. Dodge, A. Knap. 2003. Continuing long-term studies of the TROPICS Panama oil and dispersed oil spill sites. Pp.1–9 in *Proceedings of the 2003 International Oil Spill Conference*, Vancouver, Canada. American Petroleum Institute. Washington, D.C.

Wardrup, J.A. 1987. *The effects of oils and dispersants on mangroves: a review and bibliography.* Occasional paper no. 2. University of Adelaide, Environmental Studies, Adelaide, Australia.

Watkinson, R.J. and P. Morgan. 1990. Physiology of aliphatic hydrocarbon-degrading microorganisms. *Biodegradation* 1:79–92.

Weise, A.M., C. Nalewajko and K. Lee. 1999. Oil-mineral fine interactions facilitate oil biodegradation in seawater. *Environmental Technology* 20:811–824.

Wells, P. and K.G. Doe. 1976. Results of the E.P.S. oil dispersant testing program: concentrates, effectiveness testing, and toxicity to marine organisms. *Spill Technology Newsletter* 1:9–16.

Wells, P.G., S. Abernethy and D. Mackay. 1982. Study of oil water partitioning of a chemical dispersant using an acute bioassay with marine crustaceans. *Chemosphere* 11:1071–1086.

Wells, P.G., S. Abernathy and D. Mackay. 1985. Acute toxicity of solvents and surfactants of dispersants in two planktonic crustaceans. Pp. 228–240 in *Proceedings of the Eighth Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Wetzel, D.L. and E.S. Van Fleet. 2001. Cooperative studies on the toxicity of dispersants and dispersed oil to marine organisms: A 3-year Florida study. Pp. 1237–1241 in *Proceedings of the 2001 International Oil Spill Conference*, Tampa, Florida. American Petroleum Institute, Washington, D.C.

Wheelock, C.E., T.A. Baumgartner, J.W. Newman, M.F. Wolfe and R.S. Tjeerdema. 2002. Effect of nutritional state on Hsp60 levels in the rotifer *Brachionus plicatilis* following toxicant exposure. *Aquatic Toxicology* 61:89–93.

White, D.M., I. Ask and C. Behr-Andres. 2002. Laboratory study on dispersant effectiveness in Alaskan seawater. *Journal of Cold Regions Engineering* 16(1):17–27.

Wiechart, J., M.L. Rideout, D.I. Little, M. McCormick, E.H. Owens and B.K. Trudel. 1991. Development of dispersant pre-approval for Washington and Oregon coastal waters. Pp. 435–438 in *Proceedings of the 1991 International Oil Spill Conference*, San Diego, California. American Petroleum Institute, Washington, D.C.

Winters, J.K. 1978. Fate of petroleum-derived aromatic compounds in seawater held in outdoor tanks. Chapter 12 in *Environmental studies, south Texas outer continental shelf, biology and chemistry*. BLM Contract AA550-CT7-11. U.S. Department of Interior, Bureau of Land Management (BLM), Washington, D.C.

Wodzinski, R.S. and D. Bertolini. 1972. Physical state in which naphthalene and bibenzyl are utilized by bacteria. *Applied Microbiology* 23(6):1077–1081.

Wodzinski, R.S. and J.E. Coyle. 1974. Physical state of phenanthrene for utilization by bacteria. *Applied Microbiology* 27(6):1081–1084.

Wolfe, M.F., J.A. Schlosser, G.J.B. Schwartz, S. Singaram, E.E. Mielbrecht, R.S. Tjeerdema and M.L. Sowby. 1998a. Influence of dispersants on the bioavailability and trophic transfer of petroleum hydrocarbons to primary levels of a marine food chain. *Aquatic Toxicology* 42:211–227.

Wolfe, M.F., G.J.B. Schwartz, S. Singaram, E.E. Mielbrecht, R.S. Tjeerdema and M.L. Sowby. 1998b. Effects of salinity and temperature on the bioavailability of dispersed petroleum hydrocarbons to the Golden-Brown Algae, *Isochrysis galbana*. *Archives of Environmental Contamination and Toxicology* 35:268–273.

Wolfe, M.F., G.J.B. Schwartz, S. Singaram, E.E. Mielbrecht, R.S. Tjeerdema and M.L. Sowby. 1998c. Influence of dispersants on the bioavailability of napthalene from the water-accommodated fraction of crude oil to the Golden-Brown Algae, *Isochrysis galbana*. *Archives of Environmental Contamination and Toxicology* 35:274–280.

Wolfe, M.F., G.J.B. Schwartz, S. Singaram, E.E. Mielbrecht, R.S. Tjeerdema and M.L. Sowby. 1999a. Influence of dispersants on the bioavailability and trophic transfer of phenanthrene to algae and rotifers. *Aquatic Toxicology* 48:13–24.

Wolfe, M.F., H.E. Olsen, K.A. Gasuad, R.S. Tjeerdema and M.L. Sowby. 1999b. Induction of heat shock protein (hsp)60 in *Isochrysis galbana* exposed to sublethal preparations of dispersant and Prudhoe Bay crude oil. *Marine Environmental Research* 47:473–489.

Wolfe, M.F., G.J.B. Schwartz, S. Singaram, E.E. Mielbrecht, R.S. Tjeerdema and M.L. Sowby. 2001. Influence of dispersants on the bioavailability and trophic transfer of petroleum hydrocarbons to larval topsmelt (*Atherinops affinis*). *Aquatic Toxicology* 52:49–60.

Wood, P.A., T. Lunel, F. Daniel, R. Swannell, K. Lee and P. Stoffyn-Egli. 1998. Influence of oil and mineral characteristics on oil-mineral interaction. Pp. 51–77 in *Proceedings of the Twenty-first Arctic and Marine Oilspill Program (AMOP) Technical Seminar*, Edmonton, Alberta, Canada. Environment Canada, Ottawa, Ontario, Canada.

Wright, A.L., R.W. Weaver and J.W. Webb. 1997. Oil bioremediation in salt marsh mesocosms as influenced by N and P fertilization, flooding, and season. *Water Air and Soil Pollution* 95(1-4):179–191.

Wright, D.A. and G.M. Coehlo. 1996. *Dispersed oil and dispersant fate and effects research: MD program results for 1995.* MSRC Technical Report Series 95-013, Draft report. Marine Spill Response Corporation, Washington, D.C.

Wu, R.S.S., P.K.S. Lam and B.S. Zhou. 1997. Effects of two oil dispersants on phototaxis and swimming behaviour of barnacle larvae. *Hydrobiologia* 352:9–16.

Wyers, S.C. 1985. Sexual reproduction of the coral *Diploria strigosa* (Scleratinia, Faviidae) in Bermuda: Research in progress. *Proceedings of the Fifth International Coral Reef Congress, Tahiti* 5:301–502.

Wyers, S.C., H.R. Frith, R.E. Dodge, S.R. Smith, A.H. Knap and T.D. Sleeter. 1986. Behavioral effects of chemically dispersed oil and subsequent recovery in *Diploria strigosa* (DANA). *Marine Ecology* 7:23–42.

Yamada, M., H. Takada, K. Toyoda, A. Yoshida, A. Shibata, H. Nomura, M. Wada, M. Nishimura, K. Okamoto and K. Ohwada. 2003. Study on the fate of petroleum-derived polycyclic aromatic hydrocarbons (PAHs) and the effect of chemical dispersant using an enclosed ecosystem mesocosm. *Marine Pollution Bulletin* 47:105–113.

Yapa, P.D. and H.T. Shen. 1994. Modeling of river oil spills: a review. *Journal of Hydraulic Research* 32(5):765–782.

Yapa, P.D. and L. Zheng. 1997. Simulation of oil spills from underwater accidents I: model development. *Journal of Hydraulic Research* 35(5):673–687.

Yapa, P.D. and L. Zheng. 1999. Modeling underwater oil/gas jets and plumes. *Journal of Hydraulic Engineering* 125(5):481–491.

Yapa, P.D., H.T. Shen, D.S. Wang and K. Angammana. 1992. An Integrated Computer Model for Simulating Oil Spills in the St. Lawrence River. *Journal of Great Lakes Research* 18(2):34–51.

Yapa, P.D., H.T. Shen and K.S. Angammana. 1994. Modeling Oil Spills in a River-Lake System. *Journal of Marine Systems* 4:453–471.

Youssef, M. and M. Spaulding. 1993. Drift current under the action of wind and waves, Pp. 587–615 in *Proceedings of the Sixteenth Arctic and Marine Oil Spill Program (AMOP) Technical Seminar*, Calgary, Alberta, Canada. Environment Canada. Ottawa, Ontario, Canada.

Zachleder, V. and Z. Tukaj. 1993. Effect of fuel-oil and dispersant on cell-cycle and macromolecular-synthesis in the chlorococcal alga *Scenedesmus-armatus*. *Marine Biology* 117(2): 347–353.

Zagorski, W. and D. Mackay. 1982. *Studies of water-in-oil emulsions.* EPS Report EE-34. Environment Canada. Ottawa, Ontario, Canada.

Zhang, D.F., A.K. Easton and J.M. Steiner. 1997. Simulation of Coastal Oil Spills Using the Random Walk Particle Method with Gaussian Kernel Weighting. *Spill Sciences and Technology Bulletin* 4(2):71–88.

Zhang, Y. and R.M. Miller. 1992. Enhanced octadecane dispersion and biodegradation by a *Pseudomonas* rhamnolipid surfactant (biosurfactant). *Applied and Environmental Microbiology* 58(10):3276–3282.

Zhang, Y. and R.M. Miller. 1994. Effect of a *Pseudomonas* rhamnolipid biosurfactant on cell hydrophobicity and biodegradation of octadecane. *Applied and Environmental Microbiology* 60(6):2101–2106.

Zurcher, F. and M. Thuer. 1978. Rapid weathering processes of fuel oil in natural waters—analysis and interpretations. *Environmental Science and Technology* 12:838–843.

Field Plan for Water-Column Profiling to Measure Dissolved-Phase Aromatic Hydrocarbons and Free Oil Droplets as a Function of Depth and Location Relative to the Subsurface Oil Release

May 3, 2010 (Revised May 5, 2010)

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Objectives

1. Use data collected during this cruise to calibrate 3-dimensional modeling of subsurface oil plume structure, fate (dissolution behavior), and transport, by:

   a. Measuring discrete, free-oil droplet concentrations at multiple depths 2 Km up-current from the release site and at three locations (2, 4, and 8 km) down-current, or further as needed to collect water samples beyond the apparent leading edge of the plume based on updated and most accurate information at the time of sampling), and

   b. Measuring dissolved phase (BTEX and water-soluble lower-molecular-weight PAH (naphthalenes and phenanthrenes/anthracenes) at the same stations (nominally 2 Km up-current and 2, 4, and 8 Km down-current).

2. In subsequent cruise(s), use the same approach to obtain data on the effects of *in situ* dispersant injection on water quality and exposure issues. If possible, this effort will be combined with the proposed sampling associated with response monitoring undertaken for the testing of dispersant injected at depth.

Approach

1. All operations will be completed from a CSA International, Inc. (a Continental Shelf Associates company) chartered 180 ft vessel capable of working in the oiled zone (all personnel PB Safety or HAZWOPER trained). The vessel is capable of dynamic positioning and will remain in the area overnight to facilitate operations (reducing transit time from port), but due to safety and cost considerations, sampling operations will not be undertaken after dark.

2. Vessels will not operate closer than approximately 2 km of the release site, and a BP industrial hygienist will be present to ensure that OHSA-permitted exposures to benzene and other volatile hydrocarbons will not be exceeded. If levels are observed to spike above regulated levels, sampling operations will be safely terminated and the vessel will be repositioned further from the release point before sampling is resumed.

3. Upon arrival at the station locations up-current of the release site, a series of continuous Conductivity-Temperature-Depth (CTD) casts will be completed to determine the water column structure (vertical profile) for selection of water-sampling depths.[1]

4. Water samples will be collected at four depths (near bottom, just below the thermocline, mid mixed-layer (between thermocline and surface), and just below water surface, (a total of 4 samples at 4 stations = 16 total)[2] using:

    a. A remotely operated vehicle (ROV) for collecting the near-bottom samples with a 4-5 L Go Flow Bottle and

    b. A conventional hydrowire with six 5 L Go Flow Bottles and pressure controlled trip mechanisms (certified to 0.05% of specified sampling depth) to collect water samples just below the surface, in the middle of the upper mixed layer, and just below the thermocline (see separate QA Plan for NRDA Chemistry Cruise).

    c. Split or duplicate samples will be collected on 50% of the samples (VOAs (x2), dissolved-phase, and filtered oil) as specified in the QA Plan for NRDA Chemistry Cruise. These will be transferred to Entirx/BP under full chain-of-custody at the conclusion of the sampling effort. With these duplicates the total number of samples will be 24 plus associated trip, field, and equipment blanks as specified in Table 1 and the QA Plan.

    d. As available, occasional grab samples of surface oil/mousse will be collected with a jar or bucket from the sampling vessel. This will assess surface oil weathering behavior as a function of distance from the release point.

5. Immediately after sample retrieval a Portable Large Volume Water Sampling System (PLVWSS) (Payne et al., 1999; see separate PLVWSS Sampling Protocol and Water Sample Handling Procedures) will be employed on the research vessel to separate the particulate/oil phase trapped on 0.7 µm glass fiber filter and capture the dissolved phase (filtrate) in 3.8 L (1 gal) I-Chem Certified Clean amber glass jugs.

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[1] If available, a series of telemetry-equipped Acoustic Doppler Current Profilers (ADCPs) will be deployed 24 hours before the cruise to provide near-real time data on currents in the area to further guide sample station selection and positioning.

[2] It would be ideal if we could increase sampling frequency in known biologically active layers where impacts to plankton, turtles, fish, and mammals might be. If time and supplies permit, this will be attempted by increasing sampling intensity in the upper 40 feet of water or an appropriate depth based on previous data sets. This will be facilitated by an *in situ* fluorometer (with telemetry back to the sampling vessel) placed on the hydrowire just below the Go Flow Bottle.

6. The PLVWSS requires ~3.5 L of sample (for enhanced detection limits above the usual 1 L sample size, see Water Sample Handling Procedures), so before filter processing the bulk of the sample, duplicate 40 mL aliquots will be drained from the Go Flow bottle directly into VOA vials for analysis of BTEX and other alkylated benzenes. Then, after the majority of the rest of the sample is processed through the PLVWSS, the remaining 4-500 mL will be saved unfiltered for microscopic (or other) enumeration of droplet sizes and number density.

7. Maintaining complete Chain-of-Custody, freeze the filter containing the finite oil droplets and refrigerate the water sample on the research vessel.

8. Upon returning to port, transfer the NRDA samples under complete chain-of-custody to Alpha Analytical Laboratories in Mansfield, MA and the BP/Entirx duplicate/splits to B&B Laboratories [or if needed, to another lab similarly selected by the trustees and the responsible party (BP represented by ENTRIX)] for analyses of alkylated PAH by Selected Ion Monitoring and Volatile Organic Analytes (VOA) by purge and trap GC/MS.

Vessel:

All operations will be completed on the *M/V Green Provider* (180 ft) operated by Coastal Marine Logistics out of Golden Meadow, LA (see attached document for . This vessel has been chartered by CSA International, Inc. The ROV is a Super Mohawk 10,000 fsw rated ROV with twin manipulators, and a tether management system. It is based in Morgan City, LA and is available at this time.

The cruise is planned for Thursday and Friday (May 6 and 7, 2010).

Safety Plan:

A separate operations and safety plan has been prepared for review and approval before any planned operations.

Estimated Total Costs for Equipment and Ship time:

M/V Green Provider ~$24K per day (assuming 12 hr/day operations)

ROV ~$14K per day (assuming 12 hr/day operations)

The sampling activities are currently planned for daylight operations only. Additional boat personnel (crew and captain/pilot) would be required for 24 hr/day operations and this would increase the daily costs by ~$4-5K. ROV operation costs would also significantly increase for 24 hr/day operations. We will remain on station at night, but sampling activities will be curtailed with only a skeleton crew manning the vessel for safety.

Reference: Payne, J.R., T.J. Reilly, and D.P. French, "Fabrication of a Portable Large-volume Water Sampling System to Support Oil Spill NRDA Efforts," in *Proceedings of the 1999 Oil Spill Conference*, American Petroleum Institute, Washington, D.C., pp. 1179-1184, 1999.

Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment. Parties each reserve its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.

Approved by:

Lisa DiPinto, Ph.D. (NOAA)

5/10/10

Date

Ralph Markarian, Ph.D. (ENTRIX)

5/10/10

Date

Attachments:

1. Portable Large-Volume Seawater Sampling System (PLVWSS): PLVWSS Specifications, Sampling Protocols, and Power Requirements 05/05/10

2. Water Sampling Protocols in Support of the NRDA Cruise, 05/05/10

3. Data Quality Assurance (QA) Plan for NRDA Water Column Chemistry Cruise, 05/05/10

Table 1. Sample numbers and totals by station.

		Station 1		Station 2		Station 3		Station 4	
		VOA	THC/PAH	VOA	THC/PAH	VOA	THC/PAH	VOA	THC/PAH
Surface	NRDA	2	1	2	1	2	1	2	1
	Entrix Rep			2	1			2	1
	DI Blank	2	1			2	1	2	1
	Seawater Background			2	1	2	1	2	1
Mixed Layer	NRDA	2	1	2	1	2	1	2	1
	Entrix Dupe/Split	2	1			2	1		
	DI Blank								
	Seawater Background								
Mid Depth	NRDA	2	1	2	1	2	1	2	1
	Entrix Dupe/Split							2	1
	DI Blank								
	Seawater Background					2	1		
Deep	NRDA	2	1	2	1	2	1	2	1
	Entrix Dupe/Split	2	1			2	1	2	1
	DI Blank					2	1	2	1
	Seawater Background							2	1

					Total
NRDA Samples	4	4	4	4	16
BP/Entrix Samples	2	1	2	3	8
DI Water Blank Samples	1	0	2	2	5
Seawater Background Samples	0	1	2	2	5

PORTABLE LARGE-VOLUME SEAWATER SAMPLING SYSTEM (PLVWSS)

05/05/10

PLVWSS Specifications, Sampling Protocols, and Power Requirements

Container	Contents	Dimensions (inches)	Weight (lbs)	Power Requirements
Cruise Box No.1	Vacuum pump, in-line charcoal filter and water trap, vacuum gauge, support rack for 1 gallon amber-glass bottles, Teflon® stopper and suction tubing	24¼ W x 21¾ D x 19½ H	60	110 volts AC (from ship's AC outlet or portable generator)
Cruise Box No. 2	14.2 cm stainless steel Millipore® filter holder, Tygon® tubing, Teflon® solvent squirt bottles for equipment rinsing, Pall-Gelman Sciences 14.2 cm glass fiber filters, electrical extension cord, stainless steel forceps and spatula for filter manipulation	23¾ W x 23 ¾ D x 21¼ H	50	None

INSTRUCTIONS FOR SAMPLE COLLECTION AND FILTRATION

1) Place the Tygon® sampling tubing attached to the upper side of the filtration unit into the water (for near-surface samples if direct suction sampling is desired) or attach to the sampling port of the Go Flow Bottle used to collect samples at depth.

2) Plug in the vacuum pump (there is no on/off switch), and hold the Teflon® stopper firmly in the neck of the sample bottle. DO NOT FORCE THE STOPPER COMPLETELY INTO THE BOTTLE. The Viton® O-ring on the stopper is intended to make the seal with the upper lip of the sample bottle. Forcing the stopper into the neck of the bottle may cause the bottle to break, and it will certainly make it difficult to remove the stopper at the termination of sampling operations.

3) Press the Viton® O-ring on the stopper onto the top lip of the amber-glass bottle until a vacuum reading of 20 to 24 inches of Hg is obtained on the vacuum gauge attached to the pump. If the stopper starts to get sucked into the sample bottle, gently pull it out part way while still maintaining 20 to 24 inches of vacuum. Hold the stopper in place until water can be observed bubbling about 3 to 4 inches from the top of the amber glass bottle. This entire process may take from 5 to 7 minutes.

4) At this point, carefully watch the upper water level to ensure that the bottle does not become completely filled. Also, watch the vacuum tubing running from the Teflon® stopper to the in-line charcoal filter and water trap to see signs of water droplets starting to be drawn across into the trap. Stop collecting the sample when the water level is about 2 to 3 inches from the top of the 1-gallon bottle or when frequent water droplets are observed going over into the in-line trap.

5) To stop sampling, simply pull up on the Teflon® stopper to break the vacuum seal with the sample bottle. DO NOT TURN OFF THE VACUUM PUMP FIRST. This can damage the vacuum pump, and cause back diffusion of materials trapped in the in-line water trap back into the sample.

6) After the seal with the sample bottle is broken and the vacuum pressure has dropped back to ambient, unplug the vacuum pump.

7) Disconnect the Teflon® stopper from the transfer tubing coming from the bottom of the Millipore® filtration unit and wrap both ends of the tubes from the two-holed Teflon® stopper with aluminum foil. Place the original cap from the amber-glass bottle back on the bottle to seal it. Leave the sample in the pump box for safe storage until all other sampling operations are secure.

8) Drain any excess water from the tube running from the bottom of the filtration unit before opening the Millipore® filter housing. This will prevent any of the filtered material (SPM, sand, and free oil droplets) from being washed off the filter when the unit is opened. After all the water has drained from the bottom of the filtration unit, cap the tubing with aluminum foil and wrap the tubing around the legs for temporary storage.

9) Open the Millipore® filtration unit and carefully remove the outer ¼-inch circle of the glass-fiber filter from the perforated blue support base. Discard the outer edge of the filter. Using the stainless steel forceps and spatula provided with the PLVWSS, carefully fold the filter (while still on the blue support base) in half (and then in half again) to make a quarter-pie shape and then one more time making an eighth of a pie wedge. This entire operation should be done with the filter still resting on the perforated blue support base.

10) Place the folded filter wedge into a 125 mL Certified-Clean I-Chem bottle, seal and label it. The filters may be stored on ice or frozen in the field, if dry ice is available. Store frozen.

11) If another water sample is to be collected right away, place another glass-fiber filter into the Millipore® filtration unit, return the filtration unit to the cruise box/container, and proceed to the next station.

Finally, put the filtered water sample in the 1-gallor amber glass jug in a refrigerator (4°C) or cooler with frozen Blue Ice packs for storage before transfer to the analytical laboratory. Alternatively, the dissolved-phase water sample may be preserved by acidification (pH < 2 with HCl) or poisoned with 50 to 100 mL of methylene chloride. Because of air-freight shipping considerations, preservation with refrigeration and shipment with Blue Ice is preferred, particularly if next-day air delivery to the laboratory is available.

Water Sampling Protocols in Support of the NRDA Cruise **WATER SAMPLES**

Sampling Objectives

- To determine the concentration of oil compounds in the water column.
- To determine the source via fingerprinting, the degree of weathering, and background levels.
- To document exposure of water-column organisms and validate toxicity models.
- To maintain the integrity the sample(s) during sampling, transport, and storage.

Sample Volume

Analysis	*Sample Volume*	*Reporting Limit*
Volatile Aromatic Hydrocarbons (VAH)* by SIM GC/MS (collect in duplicate)	40 mL vials	0.1-1 μg/L (ppb)
Total Hydrocarbon (THC) by GC/FID	1-Liter	15 μg/L (ppb)
PAH (including alkylated PAHs) by SIM GC/MS	1-Liter	0.001 to 0.01 μg/L
	3.5 Liter	0.0005 to 0.003 μg/L

*sometimes referred to as VOA or BTEX analysis

Sampling Equipment/Containers

See separate NRDA Cruise Plan and PLVWSS procedures for use of the Portable Large Volume Water Sampling System (PLVWSS) for separating dissolved- and particulate/oil fractions by vacuum filtration immediately after collection.

- Collect VAH samples (wearing clean Nitrile gloves) by pouring directly from the collection device (4 or 5 L Go-Flow bottle or other sampler) into HCl-persevered 40 mL septum-capped vials. Ensure that there is no headspace (i.e., bubble) in the vial.
- Collect water samples for THC and PAH in glass containers, certified-clean to be organic-free (solvent rinsed). Amber glass is preferred. Leave headspace of about 1 inch for 1 L jars. If the Portable Large Volume Water Sampling System (PLVWSS) is used, the sample will first be processed by vacuum filtration through a 0.7 μm glass fiber filter as it is vacuum transferred from the Go Flow Bottle into the amber glass jug (see separate PLVWSS Protocol).
- If slicks are present, decon samplers before each use (see separate QA Plan for the NRDA Cruise). Wash with laboratory-grade detergent and clean water, with a triple clean-water rinse (distilled water from a local store is OK but laboratory grade, certified-clean DI water is better. If that cannon be obtained, clean "background" water from an up-current non-contaminated area may be used. If sampler is contaminate by an oil slick, an Alkanox wash followed by solvent rinse with isopropanol (or acetone) and methylene chloride is appropriate. (See separate QA Plan for sampler decon and blank protocol/frequency.) Collect waste solvent rinsate for proper disposal.

Sample Collection Methods

- Collect subsurface samples below the water surface so as not to include any surface oil.
- Take "near surface" samples from approximately 1 m below the surface; take "near bottom" samples within 5 m of the bottom.

- Sampling equipment MUST be deployed and retrieved in the closed position. Also applies to sample jars lowered by hand.
- On each cruise, try to sample the control/least oiled areas first, then more contaminated zones.
- Clear surface slicks with a boat hook or pole prior to deploying the equipment, but carefully so that the surface oil is not physically dispersed into the water column. Sweeping the area with sorbents may also be effective.

Preservation/Holding Times

- VAH (VOA vial): With no preservative the samples may be held for 7 days at 4°C in the dark. Addition of HCl can extend the holding time to 14 days at 4°C in the dark without loss of sample integrity.
- THC and PAH: No preservative added. Can be held at 4°C in the dark for up to 7 days.
- Immediately place all water samples in cooler and keep at 4^{o} C (do not freeze).
- Use packing material around containers to prevent breakage.
- Ship to the laboratory ASAP with complete COCs. They need at least one day to process prior to holding time expiration.
- **Volatile hydrocarbons** (benzene, toluene, ethylbenzene, and xylene, or BTEX). For oil spill applications, the standard EPA Method 8240 (purge & trap) should be modified by running the GC/MS in selected ion monitoring mode and expanding the scan list (retention times and ions) to include the higher alkylated (C3 and C4) benzenes. Detection limits should be 1 ppb for individual analytes; 0.1 ppb is possible.
- **Total hydrocarbons** (THC). Often referred to as total petroleum hydrocarbons, but most methods do not differentiate among petroleum, petrogenic, and biogenic hydrocarbons. THC by GC-FID (total area of FID gas chromatogram of combined f_1 and f_2 fractions after column chromatography) is often the preferred method because of the low detection limit (compared to other THC methods) and the direct measurement of individual hydrocarbons. This method does not detect low boiling compounds (below n-C_8). For NRDA, THC analyses generally will not provide the data needed to support calculation of toxic effects from PAH exposure, and will have to be corrected to equivalent PAHs. The THC results, however, can be used to tract oil weathering and map extent of exposure of water column resources, if meaningful detection limits can be reached. So, get a copy of the GC "trace." Detection limits are usually higher than those needed for aquatic injury assessment.
- **Polycyclic aromatic hydrocarbons** (PAH). Since most of the toxicity in oil is due to the PAHs, it is often the preferred analysis for NRDA. However, PAHs are expensive and require special laboratory skills. If PAHs are to be measured, it is important that the analytes include the alkyl-substituted PAH homologs, in addition to the standard PAH "priority pollutants." This method is referred to as Modified EPA Method 8270, because the list of PAHs is expanded to include the alkylated homologs, using GC/MS in the selected ion monitoring (SIM) mode. Detection levels should be 1 ppb for individual PAHs to support injury assessment using toxicity thresholds. Have the lab also run the source oil.

Other Considerations

- Contamination by surface slicks is of great concern. Document presence of slicks, weather, wave conditions, etc. which might suggest mixing of surface oil during sampling.

- Be aware of sources of contamination on the sampling vessel (exhaust fumes, engine cooling systems, oily surfaces). Work up-wind of any exhausts. Segregate dirty/clean areas. Lay out clean substrates to work on and replace frequently.
- Collect background samples from clean sites representative of pre-oiling conditions, as well as areas not yet oiled but in the potential path of the oil.
- Preservation chemicals should be provided by the lab.
- Use a computer or conceptual model of the extent of water-column contamination to determine the number and location of samples. Minimum guidelines are at least three samples per area of relatively uniform exposure or sub-waterbody. Also, sample along exposure gradients starting in the cleanest zone at regular intervals proportionate to the exposure area.

Contact James R. Payne at PECI for questions or additional information

jrpayne@sbcglobal.net [redacted]; cell [redacted]

Data Quality Assurance Plan for NRDA Water Column Chemistry Cruise

Purpose

This document provides general guidance for field sampling data quality assurance for the collection of NRDA field samples for planned sampling cruise on May 6 and May 7, 2010 to assist in the validation of 3-dimensional modeling of subsurface plume structure aboard the M/V Green Provider,

The current sampling plan involves sampling 4 depths at 4 stations for BTEX, THC, PAHs and free oil droplet size. Sampling requirements as outlined for basic sampling to address field program objectives for adequate description of locations are presented in Table 1. This sampling scheme is derived from the Field Plan and Sampling Protocol documents.

Table 1: Required Analytical Samples for 3-dimensional modeling data support

Sample Type	Volume Needed	**Minimum** # of samples per location
BTEX	40 mL	2 per depth
THC and PAH	1 gallon	1
Oil Droplet distribution	10 mL	10 per sample depth

In addition to basic site description, additional sampling requirements for data verification and validation, as well as equipment and procedural validation are required. These samples and the suggested frequency are described below.

Laboratory Notebook

All errata and observations that do not have a logical spot on the Chain of Custody form shall be documented in a bound lab notebook with numbered pages. Additional notation shall be written in black or blue ink. Entry errors shall be crossed out with a single line, initialed, and dated.

Blank Samples

Laboratory Grade de-ionized (DI) water in certified clean glass containers will be provided by Pace Laboratories. 5 DI water samples shall be collected, where practical, using the laboratory provided water, according to the described methodology for BTEX and THC/PAH analyses (including filtration) at each sample location. These samples shall be handled and stored in accordance with the accepted methodology for each sample type. At stations where two DI samples are collected, one shall be collected before Go-Flo bottle sample collection, and one shall be collected after the last seawater sample is collected.

Guided by fluorescence measurements from the upwind site (which is presumed to be representative of seawater not impacted by oil) the depth of minimum fluorescence will be used for the collection of a volume of background seawater. This seawater will be stored in sealed amber glass jars. Background sample blank collection shall be done in the same manner as outlined for DI sample blanks above.

Storage Procedure Monitoring

Aqueous samples shall be refrigerated to 4 °C (+/- 0.5 °C). DO NOT FREEZE. Refrigeration temperature shall be recorded when samples are stored, and periodically monitored and recorded to ensure proper refrigeration. A thermometer will be available to remain with the aqueous samples in storage for monitoring purposes.

Filter samples shall be frozen for storage. Storage temperature shall be kept at 0 °C or below. Refrigeration temperature shall be recorded when samples are stored, and periodically monitored and recorded to ensure proper refrigeration. A thermometer will be available to remain with the filter samples in storage for monitoring purposes.

Methods for sample replicates/splits

To accomplish sample splits, two methods can be employed during the cruise. Method One will be simultaneous deployment of two 5 L Go-Flo bottles which will be closed at the same depth in order to collect sample water as similar as practical. Method Two involves deploying a single 10 L Go-Flo bottle and collecting samples in series from the same bottle upon retrieval. Method One will be the preferred method. Method choice must be documented on the Chain of Custody form as **Replicate** (Method One) or **Split** (Method Two).

Sampling Equipment Monitoring

All tubing and shall be visually inspected before sampling. Sampling tubing shall be changed when contamination is visually obvious. Tubing changes shall be documented in a separate laboratory notebook (date, time, location).

Sample Depth Determination and Verification

Where practical, sample depths shall be chosen to best elucidate modeling data needs. For all samples except ROV collected samples (where depth is distance from the bottom (is fixed by the tethering equipment apparatus), depths must be preset and the depth selections recorded. Verification of triggering sequence of the CTD shall be made and documented in order to verify samples were collected as expected. Go-Flo bottles shall be numbered and numbers documented with sample station and on Chain of Custody forms. Any malfunction of the triggering of the Go-Flo bottle operation shall be documented.

General Sampling Plan for Shipboard Execution

Plan, by station and depth, to ensure the acquisition of sufficient samples, replicates, DI blanks, and seawater blanks.

Station 1 is designated as the collection point for additional background seawater samples. A 10 L Go-Flo bottle shall be used to collect seawater which will be stored in the refrigerator between uses. Additional seawater shall be collected after rosette deployment as needed.

Table 2: Sampling Schedule for NRDA Cruise May 2010

		Station 1		Station 2		Station 3		Station 4	
		VOA	THC/PAH	VOA	THC/PAH	VOA	THC/PAH	VOA	THC/PAH
Surface	NRDA	2	1	2	1	2	1	2	1
	Entrix Rep			2	1			2	1
	DI Blank	2	1			2	1	2	1
	Seawater Background			2	1	2	1	2	1
Mixed Layer	NRDA	2	1	2	1	2	1	2	1
	Entrix Dupe/Split	2	1			2	1		
	DI Blank								
	Seawater Background								
Mid Depth	NRDA	2	1	2	1	2	1	2	1
	Entrix Dupe/Split							2	1
	DI Blank								
	Seawater Background					2	1		
Deep	NRDA	2	1	2	1	2	1	2	1
	Entrix Dupe/Split	2	1			2	1	2	1
	DI Blank					2	1	2	1
	Seawater Background							2	1

	Station 1	Station 2	Station 3	Station 4	Total
NRDA Samples	4	4	4	4	16
BP/Entrix Samples	2	1	2	3	8
DI Water Blank Samples	1	0	2	2	5
Seawater Background Samples	0	1	2	2	5

ENTRIX	WATER COLUMN PROFILING SERVICES	CSA

Water Column Profiling Services to Measure Dissolved-Phase Aromatic Hydrocarbons and Free Oil Droplets as a Function of Depth and Location Relative to the Subsurface Oil Release

GOM BLOCK

MISSISSIPPI CANYON 252

PROJECT HSE PLAN

ENTRIX Corporation

CSA International, Inc. (CSA)

REVISION STATUS			APPROVAL		
Rev	**Date**	**Reason for Issue**	**Originator**	**Reviewed**	**Approved**
A	4-May-2010	Issued for Comment	L. Powell		

Dist:	**Subject**	**HSE Management**				
As per page 2	**Activity:**	**Project HSE Plan**				
	Location:	**GOM Block MC252**				
		Location	Disc	Document Type	Sequence No	Rev
	Doc. No.					**1**

PARTY APPROVAL FOR USE IN OPERATIONS

ENTRIX ~~Ryan Holem~~ Stephen C. Dunham, CIH (Bureau Veritas) HSE Manager RH 5/5/10	**CSA** Lynwood Powell HSE Manager

Record of Document Issue

Name	Company / Department	Copy No.	Date
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James Payne	Chief Scientist-Payne Env. Consultants		
Ryan Holem	~~HSE Manager~~ Senior Staff Scientist RH 5/5/10		
CSA			
Fred Ayer	VP/Project Manager-Stuart, FL		
Bruce Graham	Project Senior Scientist-Field		
Lynwood Powell	HSE Manager-Stuart, FL		
Tony Wadley	Site Safety Coordinator-Field		
Frank Johnson	Operations Director-Field		
Terry Stevens	Operations Manager-Field		
Gordon Stevens	Operations Manager-Stuart, FL		

TABLE OF CONTENTS

1.0 INTRODUCTION

ENTRIX has contracted CSA International, Inc. (CSA) to conduct a Water Column Profiling Survey (WCPS) to Measure Dissolved-Phase Aromatic Hydrocarbons and Free Oil Droplets as a Function of Depth and Location Relative to the Subsurface Oil Release in Mississippi Canyon Block 252 (**Figure 1**). The objective of the project is to collect data to calibrate 3-dimensional modeling of subsurface oil plume structure, fate, and transport.

CSA has chartered the M/V Green Provider as the support vessel to conduct all survey operations for this project. The survey will consist of performing water column profiles using a General Oceanics model 1018 Rosette Water Sampling system and hydrographic profiles using a Seabird SBE-19 Profiling Conductivity-Temperature-Depth (CTD). Also a Teledyne-RDI Acoustic Doppler Current Profiler (ADCP) will be mounted on an over-the-side pole and used to collect real-time water current data. In addition a Sub-Atlantic Super Mohawk ROV system will be used to collect sediment and water samples and record video at the seabed. The survey vessel will deploy all sampling equipment at predetermined locations using a-frame, davit and winch systems. Within MC Block 252, water depths are expected to be approximately 5,000ft.

This document represents CSA International, Inc. (CSA) health, safety, and environment (HSE) policies and procedures for the ENTRIX WCPS. CSA is responsible for the overall safety management of the survey program.

Marine sampling can be inherently hazardous, and proper precautions need to be taken. Precautions for general vessel safety and chemical hazards to be observed on all CSA surveys are discussed in this document. The physical hazards unique to sampling equipment and operations and sampling precautions are discussed. The Project Scientist and the Site Safety Coordinator are responsible for ensuring that CSA HSE policies and procedures are consistently followed and enforced. Sampling activities will be suspended if the safety of the work crew cannot be ensured. Due to safety considerations all operations will be conducted during daylight hours only.

Details of the field plan and sampling locations can be found in **Attachment A-Field Plan**.

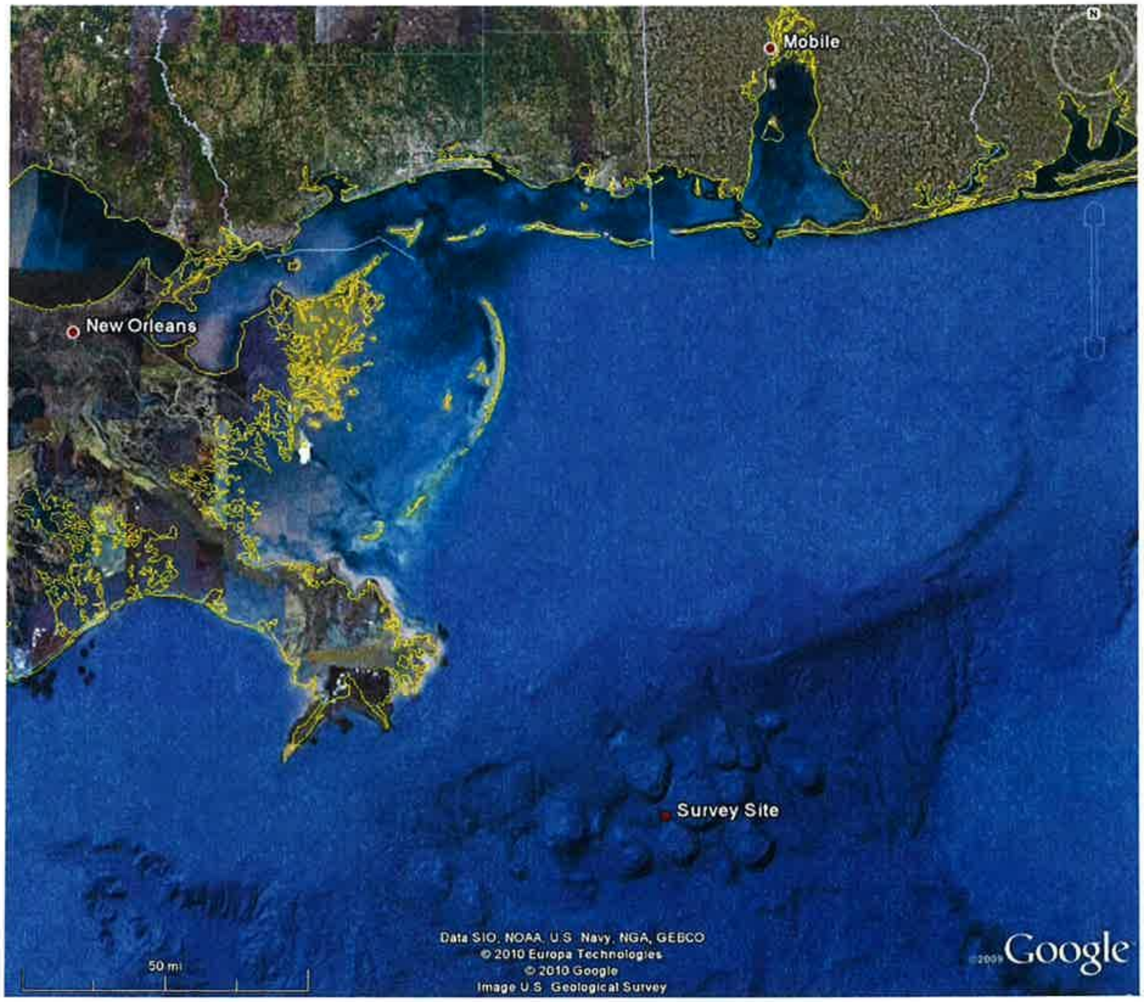


Figure 1. Location of Survey Site in Mississippi Canyon Block 252

1.1 General HSE Policy

This HSE Plan specifies the safety rules and standards for all CSA personnel and subcontractors during field onshore, shipboard, and laboratory activities. The HSE Plan is a tool to help implement and maintain the CSA safety policies and procedures.

1.1.1 CSA HSE Goals

The safety goal for CSA is to prevent all injuries, protect worker health, and cause no damage to the environment. CSA is vitally concerned for the health and safety of all its employees, subcontractors, facilities, and materials used during all phases of operations. We rely on each employee to actively support and implement the HSE policies and procedures. All CSA personnel are responsible for HSE compliance. The HSE policies are intended to create and maintain a safe working environment for all employees and protect the environment.

All employees and subcontractors are to be familiar with the client's HSE policies and work rules. In particular, all employees and subcontractors are to read from the client's corporate safety manuals all sections pertaining to:

- client sites that may be visited by CSA personnel during the conduct of CSA's work; and
- any activities which are procedurally similar to CSA's activities for the project.

PROJECT OPERATIONS WILL BE SHUT DOWN
IF SAFETY OF PERSONNEL CANNOT BE ASSURED

1.1.2 Site Safety Hazard Analysis and Risk Assessment

The Site Safety Coordinator will perform a site safety hazard/risk analysis as necessary for any special operations which might be required for this project. Safety procedures are routinely assessed for effectiveness specific to the project. The Site Safety Coordinator monitors safety procedures and evaluates them on a specific task by task basis. This information is relayed to the CSA Corporate Safety Supervisor and changes, if any, are made to further ensure personnel safety.

A project-specific Hazards Analysis/Risk Assessment is presented in **Appendix A**. **Table 1** provides the risk ranking descriptions. The HSE Risk Assessment was conducted for each potential hazard by ranking the consequence of the hazard and likelihood of the hazard occurring as summarized in **Table 2**.

Table 1. Risk ranking descriptions.

Risk Ranking	Description
A	Broadly acceptable
B	Tolerable
C	Subject to further study; identification of risk reduction measures and Cost Benefit Analysis
D	Subject to further study; identification of risk reduction measures and Cost Benefit Analysis
E	Unacceptable

Table 2. Risk matrix.

Likelihood of Occurrence		Consequence of Hazard				
		1	8	16	50	100
		Minor	Moderate	Major	Critical	Catastrophic
0.5	Insignificant	A (0.5)	A (4)	B (8)	B (25)	C (50)
1	Remote	A (1)	B (8)	B (16)	C (50)	D (100)
2	Infrequent	A (2)	B (16)	C (32)	D (100)	D (200)
5	Occasional	A (5)	C (40)	C (80)	D (250)	E (500)
10	Frequent	B (10)	C (80)	D (160)	E (500)	E (1,000)

1.1.3 Deviation from Safety Standards

Any deviation from the standard safety requirements as outlined in this HSE Plan and the client's particular Corporate Safety Manual shall be registered by the Site Safety Coordinator with the appropriate feedback from personnel. Follow-up by the Site Safety Coordinator requires reporting any deviations to the CSA Corporate Safety Supervisor.

1.1.4 Management of Change

If for any reason there is a request to make changes, the following will apply: The ENTRIX Representative will be notified of any changes to material, equipment, personnel, or procedures that could affect the safety of the operation or materially affect the scope or completion of the work.

Changes to any aspect of the work program will be subject to a risk assessment by CSA and ENTRIX to ensure any potential adverse effects of the change may be identified and either eliminated or controlled to minimize risk as much as reasonably practicable. Proposed changes will require the approval of the CSA Project Manager (or a designated representative) and the ENTRIX Technical Representative prior to implementation. Any such changes or additions to the operation and the subsequent risk assessment will be communicated prior to implementation to all relevant personnel likely to be affected by the change.

Any implemented change will be documented by completing a CSA Management of Change Order (See **Appendix C-Forms**).

2.0 LINE MANAGEMENT

2.1 Site Safety Coordinator

The Site Safety Coordinator for this project will be **Tony Wadley** and his role in the project includes the following:

- HAZWOPER/CPR/First Aid trained;
- Ensures that first aid supplies are in good order and easily accessible;
- Conducts pre-mobilization safety briefing;
- Conducts daily safety/tool box meetings at the beginning of each day and notifies the client representative if any conditions or specific health and safety hazards will be encountered during the work to be done during the day;
- Responsible for ensuring all safety rules are followed and understood;
- Understands that if unsafe conditions exist, personnel are not required to work; and
- Will not rush to complete a job at the expense of safety.

2.2 Project Scientist/QA Coordinator

The Project Scientist/QA Coordinator for this project will be **Bruce Graham** and his role in the project includes the following:

- Responsible for data collection and quality;
- First line of incident reporting;
- Coordinates daily survey progress assessment meetings;
- Responsible for reporting and recording all injuries, accidents, and near misses to the designated client representative on board and to the CSA home offices. The initial report will be oral, which will then be followed by a written record; and
- HAZWOPER/CPR/First Aid trained

2.3 Operations Director

The Operations Manager for this project will be **Frank Johnson** and his role in the project includes the following:

- Coordinates with Project Scientist on overall survey goals;
- Coordinates operations with ship's crew;
- Responsible for equipment installation and operation;
- Responsible for daily operations of sampling equipment; and
- HAZWOPER/CPR/First Aid trained.

2.4 Operations Manager

The Lead Technician for this project will be **Terry Stevens** and his role in the project includes the following:

- Insure all sampling equipment is in proper working order;
- Inspects CSA equipment daily to ensure it is in proper working order;
- Assist in sample/data collection and processing;
- Responsible for implementing safety procedures; and
- HAZWOPER/CPR/First Aid trained.

**EACH EMPLOYEE IS RESPONSIBLE FOR HIS OWN AND OTHERS' SAFETY.
HE ALSO HAS AN OBLIGATION TO WORK SAFELY AND REPORT ANY UNSAFE CONDITIONS.**

3.0 HAZARD COMMUNICATION

3.1 General

All employees and contract personnel are informed of all potential health and safety hazards related to the project and are instructed on how to avoid the risk of an accident. When operating offshore CSA personnel will conduct daily meetings and communicate progress with onshore support. Personnel to relay program status and any logistical concerns and requirements via SAT Phone email.

3.2 Reporting

All survey personnel will be provided with sampling guides that summarize sample collection and processing activities and identify potential hazards.

In the event of an injury accident the Site Safety Coordinator initially will notify the Project Manager and/or Project Director and the client or its agent verbally. An Incident/Accident Notification form will be completed within 24 hours of an accident/injury/near miss and a copy will be sent to the CSA HSE Manager. "Incident/Accident Notification" forms (**Appendix C**) will be kept on site.

A daily progress report will be prepared for the HSE manager and will detail the technical aspects of the sampling acquisition as well as details and will include the following:

- Close calls/near misses;
- Any unsafe condition;
- Any CSA employee having a problem working safely;
- Any accident/incident;
- Any failure of safety equipment;
- Hazard reports & safety observations;
- Inspections & audits completed;
- Emergency drills completed;
- Personnel on Board;
- HSE issues or concerns; and
- Interaction with other vessels and fishermen

3.3 Project Site

Mobilization/Demobilization: Golden Meadow, Louisiana
Survey Site: GOM Block MC252 RH 5/5/10
Schedule and Duration: Mobilization – May ~~5-6~~ 6-7 2010; 2 day survey
Weather: Monitored and assessed daily

3.3.1 General Vessel Safety

To ensure adequate preparation for emergencies that may possibly arise, prior to selecting and/or chartering a vessel for survey operations, the Site Safety Coordinator will ensure that the proper safety equipment are or will be available when the vessel is mobilized for a survey. If any equipment are not available (e.g., in foreign countries where vessels of opportunity are used) arrangements should be made to have the safety equipment made available either from in-country sources or by shipping them to the mobilization port.

3.3.2 Pre-Mobilization Safety Briefing (PMSB)

A Pre-mobilization Safety Briefing will be conducted by the CSA Site Safety Coordinator and the ENTRIX HSE Manager.

The following list is a summary of items to be discussed:

1. Description of project and goals
2. Communications – key to acquiring goals
3. Team members, assignments, and shifts
4. Coordination with ship's crew
5. Designation of person in charge on deck
6. Complexity of the operations – moving platform, machinery, openings
7. Pre-operation checks – vessel preparation
8. Safety equipment – vessel and sampling
9. Hazards - vessel and equipment – Hazid Actions/JSA/Toolbox
10. Limitations of personnel and equipment (Lifting, rigging, and safe working loads)
11. Environmental conditions (wind, weather, sea state, etc.)

An HSE induction for all personnel involved with the offshore field survey will be conducted by CSA prior to or during vessel mobilization.

All vessel crew members will be briefed on the operation of all primary sampling equipment, cranes, winches, blocks, cables, and A-frame prior to mobilization.

It is the responsibility of the Site Safety Coordinator and survey team members to ensure that proper rigging and lifting procedures are used.

The vessel's captain will be responsible for conducting the following drills: M.O.B., Fire, Abandon Ship, and Medical Emergency. These drills will be conducted once before the survey begins and weekly thereafter.

3.3.3 Chemical Hazards

Isopropyl Alcohol, Hexane, and Liquinox will be used during the field surveys. Material Safety Data Sheets (MSDS) for each chemical product will be aboard the vessel located near the chemicals and on the bridge. All personnel will be aware of the chemical products being used and safety considerations needed to prevent injuries.

The Site Safety Coordinator will ensure that field personnel review all relevant Material Safety Data Sheets (MSDS) before mobilizing for a field survey.

It is the responsibility of all personnel on board to take advantage of the information available, to wear the protective equipment provided, and to follow recommendations for handling any hazardous material.

Protective safety equipment will be worn when handling hazardous chemicals and include: chemical-resistant gloves, laboratory aprons, safety glasses or goggles, masks, and/or respirators.

In some areas, contact with marine sediment may present a potential health hazard from chemical and/or biological constituents of the sediment. Possible routes of exposure to chemical/biological hazards include inhalation, skin and/or mucous membrane absorption, ingestion, and injection. Potentially hazardous chemical/biological sediment constituents may include hydrogen sulfide, mercury and other heavy metals, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, solvents, and various types

of bacteria and viruses. Other potentially hazardous substances may include chemicals used as sample preservative agents or sampler decontamination agents.

Crew members should exercise caution to avoid coming into contact with potentially contaminated sediment during sampling operations. Crew members should exercise good personal hygiene after sampling and prior to eating or drinking.

Exposure to airborne contaminants can be greatly reduced if the vessel steams to windward in a way that minimizes risk to the sampling crew from exposure to volatiles. Having respirators on hand will reduce exposure to volatile fumes that may be present when mixing large quantities of chemicals or using a solvent rinse during equipment decontamination.

During sampling, caution, common sense, and good judgment should dictate appropriate safety gear to be worn in any given situation on deck. Hardhats, gloves, and steel-toed shoes must be worn in working conditions where there is a possibility of injury to the head, hands, or feet. Work vests must be worn while working on the fantail, or while working near an open gunwale. If in doubt, survey team members should ask the designated Site Safety Coordinator.

Collecting samples in extremely hot and humid weather carries the risk of dehydration and heat stroke. Survey team members should carry an adequate supply of potable water or other liquids for protection against dehydration in hot weather. The Site Safety Coordinator will ensure that survey team members continually drink to replace lost fluids in periods of work in hot weather.

3.4 Areas of Safety Concern

3.4.1 Mobilization

There is a large variety of marine sampling equipment in use today, and each has the potential for causing serious injury. Many types are heavy, ranging from under 50 lbs for a small sediment grab or plankton net to up to 2,000 lbs for a large Ewing piston corer. Unless the equipment is secure on deck or fully deployed and submerged, care must be taken to avoid crushing or other impact-related injuries from the handling of this gear.

This project will use a large ROV to collect all chemical and infaunal samples. The ROV is very heavy and all personnel must be aware of the corer weight and potential for uncontrolled motions during deployment and recovery. Proper tag line procedures will be stressed during the pre-mobilization briefing. Work gloves will be worn at all times when using tag lines.

Also, an appreciable amount of vertical clearance is usually required to clear the gunwale during deployment and retrieval, which in turn can increase the risk of uncontrolled lateral motion unless suitable tag lines are used.

A typical box corer is fairly heavy (from 200 to 900 lbs) and is also both tall and wide at the base. At least 100 square feet of deck area is required to safely manage this equipment. Good foot protection is mandatory when handling this equipment.

Essentially all types of sediment grabs utilize their own weight, some type of tensioning device, or other form of mechanical advantage to actuate the sampler upon contact with the bottom. Care must therefore be taken to minimize the risk of accidental or premature closure while handling. The box corer for this project has a release which triggers upon contact with the bottom. The sample is collected during retrieval.

In general, all sampling equipment uses the same type of marine hardware to attach to the appropriate lifting device. Periodically, all connections (e.g., cabling, shackles, pins, swivels, etc.) should be inspected to ensure the integrity of all points along the sampling assembly. The placement of the survey equipment on the deck will be discussed with the captain to assure safety and structural concerns are addressed. Welders attaching equipment to the vessel need to be certified in the operation of the welding and cutting equipment as well as using the appropriate materials to secure the equipment to the vessel. Tag lines will be attached to all equipment when it is being placed on or removed from the vessel.

Concern: Lifting equipment onto vessel.
Precaution(s): Lift with legs, back straight, good footing, and avoid twisting. Get help if load is too heavy. Avoid pushing, pulling, or prying while working aloft. Approved hard hats and safety boots/shoes with toe protection should be worn while working on the fantail.

Concern: Slippery deck.
Precaution(s): Guard rails; shoes, boots with sufficient anti-skid soles to minimize potential for slippage; employees to wear personal floatation device (PFD) while on the work deck at sea and if transfers are required.

Concern: Installation of equipment.
Precaution(s): Secure all equipment in case of rough seas. In the case of installation of navigational antenna and cables, two people will be on hand at all times for this part of the mobilization and will inform vessel captain of antenna installation and positioning and have the radar unit switched off (antennae should not be moving).

Concern: Loose containers.
Precaution(s): Secure all shipping containers to ensure they cannot break loose and cause physical harm during rough sea condition.

Concern: Confined space.
Precaution(s): Keep clean and ventilated. Check for proper lighting. Conform to vessel permit to work and confined space entry requirements

Concern: Lock out/tag out procedures (faulty equipment).
Precaution(s): Unplug equipment before doing repair and tag it as such. Reactivate the system only through an established and published procedure that ensures each person has removed his own lock and tag first.

Concern: Installation of first aid kit.
Precaution(s): Ensure all personnel are aware of the location of the first aid kit on the vessel.

Concern: Location of fire extinguishers.
Precaution(s): Ensure all personnel are aware of the location of the fire extinguishers on the vessel.

3.4.2 Offshore

A sampling device is least secure while suspended in the air during the transitional period between the deck of a vessel and the surface of the water; a pitching and/or rolling deck during rough weather will aggravate this situation. Care must be taken to ensure that sufficient restraining, or tag lines or other devices are in place to meet these conditions. Because of the increased potential for damage or injury, all personnel on deck and in the wheelhouse must be notified before a sampling device leaves the deck during deployment or breaks the surface upon retrieval. If the winch operator is remotely located from the

scene of operations, a clear system of signals must be established between the lead deck person and the winch operator, usually via hand signals or electronic communication.

OSHA requires that hard hats be worn when working beneath suspended equipment, or when the potential of injury to the head exists due to lateral impact. All crew members should have a suitable level of seamanship skills, based upon their level of responsibility. Listed below are some of the items related to seamanship and gear-handling that, when overlooked, have been known to cause serious accidents on board ship.

- A capstan is potentially more dangerous than a winch drum, as the wraps are not enclosed and could instantly slip off the end if not handled properly.
- If a hydraulic hose fails, winches can free-wheel, and load-bearing rams can collapse under a load unless backed up with balance-check valves.
- Different kinds of line and wire rope have different characteristics, which may not be suitable for all applications (e.g., nylon is 25 percent stronger than polypropylene, but it is much more elastic and can be lethal if parted under a strain; polypropylene will float, making it less susceptible to propeller entanglement).
- An eye splice over a thimble will only cause a 5 percent reduction in line strength, but a knot (depending on type) can reduce the strength in a line by as much as 55 percent due to unequal strain on the fibers (a line will usually break under a strain at that point where it is forced to bend).
- Theoretically, the longer a line under a strain, the weaker it is when compared against its rated breaking strength (the chances are statistically greater of encountering a section weaker than the last as line length increases).
- The recommended working load-to-breaking strain for wire rope and line is typically 1 to 5. If the load ever exceeds 75 percent of the breaking strength, permanent damage could result, which can lead to unexpected breakage.
- Topside operations may be more dangerous on larger ships than smaller vessels because it is harder to keep track of safety concerns when activities are spread over a larger area of deck.
- Crew members should always stand clear of slack or looped line lying on deck to avoid entanglement. A sudden strain on slack line can entrap arms and legs; personnel may be severely injured or carried overboard.

In the event the sediment grab or winch wire becomes entangled in an object on the bottom, in the ship's propellers, or as a result of a malfunction in the winch or a-frame, the personnel on the bridge will be notified immediately.

The Operations Manager conducting sampling operations will confer with the ship's master and will direct the survey team members and vessel personnel in order that the situation is safely resolved.

Inclement weather may introduce additional hazards. Heavy equipment can be much more difficult to manage, and footing may become unsure due to slippery decks and/or increased vessel motion, and the risk of falling overboard may increase. Some state agencies requires that all railings be a minimum of 36 inches in height, and OSHA requires that an approved life vest be donned when working over the water or if there is an increased risk of falling overboard. A safety line will be secured across the opening from which the survey equipment will be deployed and retrieved. Vessel accommodations should be able to provide relief to crew members in case of cold or heat stress.

The vessel's Captain is responsible for determining the relative safety due to inclement weather on all operations. If necessary, survey operations will be suspended. The Captain will decide whether to stay on station or transit to port until weather conditions improve. If operations are suspended the Operations Manager will direct the movement and securing of equipment and materials until sampling resumes.

Concern: Chemicals.
Precaution(s): Familiarization with use and handling of chemicals to be used on project. Splash-proof goggles, organic vapor masks, and protective gloves will be used when handling chemicals. Chemicals will only be used in well-ventilated areas.

Concern: Acids, bases, and other hazardous chemicals.
Precaution(s): Briefing and MSDS sheets regarding all hazardous chemicals. Use of rubber gloves when handling dangerous chemicals such as water quality fixatives. Availability of first aid kits, eye wash kits, and spill kits. Prior to applicable activities, the Site Safety Coordinator will remind survey team members of the location of first aid kits, eye wash kits, and spill kits.

Precautions should be taken when handling hazardous materials during sampling and sample processing. Gloves and safety glasses should be worn as needed.

Concern: Man overboard.
Precaution(s): Single (one) employee is not allowed on rear deck of the vessel alone – two men or more are required on deck during at-sea operations. All employees are to wear PFDs while on deck of the vessel.

3.4.3 Winch and Davit Operations and Safety Procedures

CSA will be utilizing the services of Coastal Marine Logistics (CML) who will provide the vessel M/V Green Provider to facilitate the sampling effort. An a-frame/davit was constructed to serve as the deployment/retrieval system for the rosette water sampler. The a-frame/davit is welded to the gunwale and deck and exceeds any loads anticipated for the field survey tasks. The winch will be the CSA deepwater electro-hydraulic unit manufactured by Sea-Mac.

CSA and CML are responsible for training field personnel in the safe working procedures of the equipment being utilized for this project. Under the terms of the contract, CSA and CML will provide competent personnel to carry out the work. As such CSA and CML will address the a-frame, davit, and winch systems which include electro-hydraulic winches and hydraulic power units (HPU). The purpose of this document is to outline a systematic approach to mobilization, training, and standards which will optimize safety and program efficiency.

Systems safety and operational planning and implementation are a two-tier function:

1. Pre-cruise planning will address the specific operational requirements associated with the equipment. It is the responsibility of the Operations Manager to ensure that all requirements relative to mobilization, operation, and maintenance are implemented through in-house planning and discussion.

2. On-board, prior to the actual operation, it is the Operations Managers responsibility to coordinate mobilization, training, and operational procedures with the ship's Captain and crew, CSA Technicians, Project Scientist, and Operations group. This is to ensure that all individuals involved clearly understand what is required of them and that all equipment is appropriate and have been inspected.

The following points will be addressed during the Pre-mobilization Safety Briefing and Operations Training:

- Read all warning tag information and become familiar with all controls before operating winch.
- Never attempt to clean, oil, or perform any maintenance on a machine with the engine or prime mover running, unless instructed to do so.

- Never operate winch controls unless you are properly positioned at the operator's station and you are sure personnel are clear of the work area.
- Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
- Ground personnel should stay in view of the operator and clear of winch drum. Do not allow ground personnel near winch line under tension. A safe distance of at least 1-1/2 times the length of the unspooled cable should be maintained.
- Inspect rigging and winch at the beginning of each work shift. Defects should be corrected immediately.
- Keep equipment in good operating condition.
- Do not exceed the maximum pressure, PSI (kPa), or flow, GPM (LPM), stated in the winch specifications for hydraulically driven winches.
- Match winch line speeds to job conditions.
- Leather gloves should be used when handling winch cable.
- Never attempt to handle winch cable when the hook end is not free. Keep all parts of body and clothing clear of cable rollers, cable entry area of fairleads and the winch drum.
- When winding winch cable on the winch drum, never attempt to maintain tension by allowing winch cable to slip through hands. Always use "hand-over-hand" techniques, being careful to keep hands and clothing away from winch drum and fairlead rollers.
- Never use winch cable with broken strands. Replace winch cable.
- Do not weld on any part of the winch.
- Use recommended hydraulic oil and gear lubricant.
- Install guarding to prevent personnel from getting any part of body or clothing caught at a point where the cable is wrapped onto the drum or drawn through guide rollers.
- Install switches or valves which will shut off power to the winch in locations where they can be reached by anyone entangled in the cable before being drawn into the winch or any "pinch-point."
- "Deadman" controls, which automatically shut off power to the winch whenever the operator leaves his station, should be installed whenever practical.
- Never allow anyone to stand under a suspended load.
- Avoid sudden "shock" loads or attempting to "jerk" load free. This type of operation may cause heavy loads in excess of rated capacity, which may result in failure of cable and winch.
- It is imperative that the person operating the unit follow directions while maintaining situational awareness for the task at hand.

Never put your hands into, around, or near the spool or rollers when operating.
Serious injury can occur!

3.4.4 Demobilization

At the completion of all planned survey tasks there can exist the opportunity for injury due to survey team members and ships crew rushing demobilization efforts. When these demobilization procedures are performed too quickly the risk of an accident is increased.

3.4.4.1 Offshore

Concern: Personnel anxious to disembark vessel.
Precaution(s): Must use cautious, methodical procedures.

Concern: Loose trash/debris.
Precaution(s): All trash/debris will be stored and removed.

Concern: Transferring equipment/personnel from vessel to dock. Dropped objects
Precaution(s): PFDs required (see also slippery deck hazard).

3.4.4.2 Onshore

Concern: Personnel anxious to disembark.
Precaution(s): Must use cautious, methodical procedures.

Concern: Loose trash/debris.
Precaution(s): All trash/debris will be stored and removed.

Concern: Safe disposal of trash, hazardous chemicals, fixatives, etc.
Precaution(s): Careful identification, marking, disposal, packing, and transport (if required) of hazardous materials. Proper neutralization of chemicals will be completed if required.

Concern: Leakage of sample preservatives (mostly formaldehyde).
Precautions: Briefing on safe handling of formaldehyde and other possible fixatives. Double bagging of fixed samples, eyewash capabilities, flushing of neutralization of skin contact.

3.5 Emergency Program

The vessel master has a direct responsibility for the health, safety and welfare of all persons on board and for dealing with the immediate response to emergencies. In the event of an emergency CSA will provide emergency response management in cooperation with the vessel's captain to insure the health, safety, and welfare of all persons on board. The Site Safety Coordinator will work along side the captain in the event of a medical emergency.

In the event of injury or illness to personnel, CSA have responsibility for the evacuation of any person on board from the vessel to the nearest port or heliport, depending upon the nature and severity of injuries. From there CSA have responsibility to transfer their own and subcontractor personnel to hospital for treatment. ENTRIX has responsibility for the transfer, hospitalization and ongoing welfare of their own personnel. CSA and their subcontractors have full responsibility for the response to and management of all emergencies arising onboard or involving the vessel.

CSA will mobilize an AED and First Aid Kit for the survey. All CSA personnel are trained in the proper use of an AED and First Aid administration.

3.5.1 Personnel on Board (POB)/Next of Kin (NOK)

A POB/NOK list for the vessel shall be issued prior to departure from the harbor and will be updated should personnel change out, which is not currently planned. Copies of the vessel POB/NOK lists will be transmitted to CSA and ENTRIX offices. All parties will undertake to keep the NOK information confidential.

In the event of an emergency, CSA where necessary shall liaise with the relevant authorities and provide a verified POB list. The onshore response personnel of CSA (and 3rd party contractors if necessary), will be responsible for providing support to relatives of CSA personnel and subcontractors on board during an emergency. The ENTRIX response team would take this responsibility for ENTRIX vessel personnel.

Prior to vessel mobilization medical evacuation support services were researched in south Louisiana. A hospital and helicopter service, identified prior to mobilization, will be contacted in the event of an emergency.

3.5.2 Overall Strategy

An emergency is defined as an unplanned event, or situation, which poses an actual or potential threat to the safety or integrity of:

- Life and limb or health of personnel on board the vessel
- The environment or,
- The reputation of CSA or ENTRIX

An emergency can be further defined as any event, incident or situation, which poses a continuing threat and requires the mobilization of assistance or support from sources external to the affected party.

Both offshore and onshore emergency response actions will be clear, co-coordinated and will be based on the agreed arrangements listed in this document.

CSA emergency response team will take the lead role in responding to all emergencies.

Local services will respond in an emergency to provide support to CSA. Depending upon the nature and scale of the emergency, the CSA shore support may also respond.

In event of an emergency, a number of CSA personnel will remain on call for the duration of the ENTRIX contract. CSA will have a team on standby in Florida to provide support, consisting of the CSA HSE Manager, an Operations Manager, and other support personnel as required.

Vessel

The vessel captain and the CSA Site Safety Coordinator in cooperation with the ENTRIX HSE field representative will insure Muster, Fire, MOB, loss of power, and Communication drills will be run before beginning field tasks. The Fire drill will include pressure to and discharge of the fire hoses.

3.5.3 Post Event Incident Reporting

Formal written reports will be prepared by CSA after an emergency has been resolved. A report need not be final, but may be an interim or preliminary document. A report should not only identify the sequence of events and causes of the incident, but also the adequacy of the response and corrective actions.

3.5.4 Emergency Response

Responsibilities during an emergency include the following:

Offshore Response

Vessel Master-M/V Green Provider	
Responsibility:	Safety of all persons on board the vessel Overall control of the vessel Emergency Response Team On-scene commander Liaison with other vessels if in the survey area Obtaining medical advice as required
Actions:	Controlling emergency and safeguarding personnel Notify the relevant authorities, if necessary Notify CSA On-Duty Operations Notify the ENTRIX representative on the vessel Calling onshore medical authorities
ENTRIX HSE Representative	
Responsibility:	Providing assistance to the Vessel Master as requested Initial notification of ENTRIX HSE Manager
Actions:	Call duty person as above and inform them of nature of emergency and onshore assistance if required.

Local Onshore Response

CSA Project Manager	
Responsibility:	Primacy for supporting the vessel and coordinating the onshore emergency response in accordance with CSA Emergency Response procedures.
Actions:	Coordination of emergency response via the existing CSA emergency response organisation and arrangements, including provision of logistical support Notification of and Liaison with external agencies including Medical Support Notification and regular updating of ENTRIX representative. Informing CSA personnel and subcontractor NOK of injuries etc. Arranging medivacs to shore in response to injuries, illness or other incidents on board for all POB. Arranging reception and transfer to hospital for any injured CSA or subcontractor personnel
ENTRIX HSE Manager	
Responsibility:	The health, safety and welfare of ENTRIX personnel involved in any emergency, once they have returned to shore. The reputation and standing of ENTRIX
Actions:	Mobilize to ENTRIX offices in response to call out from ENTRIX Survey Rep. Keep updated of events via CSA emergency personnel Make arrangements to meet and greet any injured or affected ENTRIX personnel in port or heliport as required Arrange transfer and hospitalization of injured ENTRIX personnel as required Arrange for medivacs as required for ENTRIX personnel Ensure notification of NOK for any affected ENTRIX personnel. Seek support on preparation and issue of media statements as required, in conjunction with CSA.

3.5.5 Emergency Response Organization

The response organization for the baseline environmental survey is shown in **Figure 2** below. Call out and communication routes are also shown in this figure.

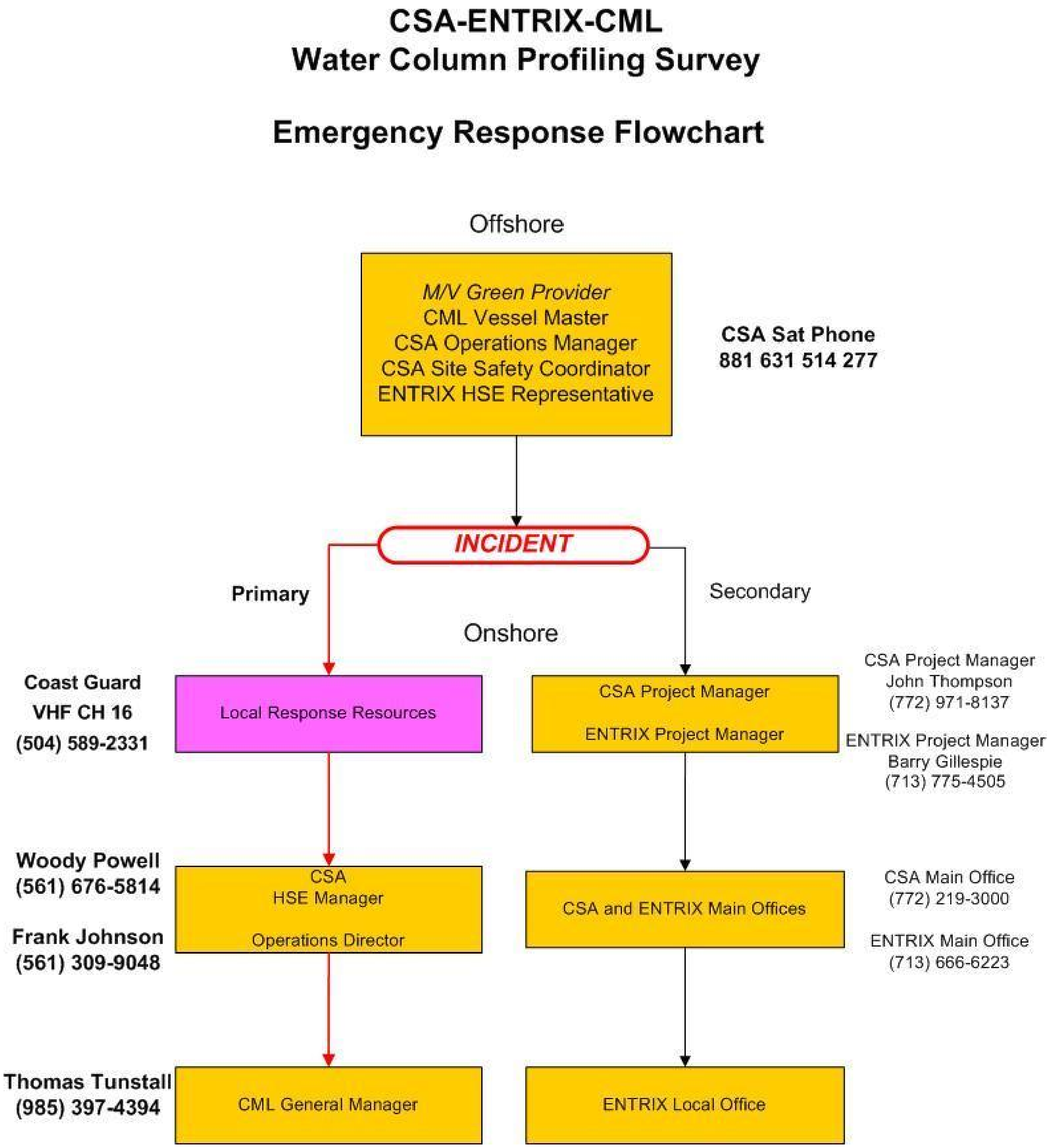


Figure 2. Emergency Response Organization Flowchart

3.5.6 Medivac Plan

Should a medical emergency require the immediate evacuation of a person or persons from the survey vessel, the vessel should immediately head toward the nearest shore facility. The Coast Guard should be contacted immediately on VHF channel 16. The Coast Guard air station is located approximately 13 miles south of New Orleans in Belle Chasse, La

Any applicable client transport coordinators or helicopter dispatchers should be contacted by either satellite phone or cellular telephone for assistance with the emergency. They will arrange helicopter evacuation of the injured person(s) from the platform or shore facility to the nearest emergency medical facility. If medical treatment is needed for a non-life threatening situation, the vessel should head to the nearest shore facility from which the injured person(s) can then travel to the nearest medical facility to obtain necessary medical treatment.

The arrangements listed in this document shall apply to the Emergency Response Procedures for the period that the vessel is contracted for the purpose of completing the survey.

Emergency contact numbers for communications during emergency situations are provided below.

Vessel Emergency Contact Numbers

Vessel-M/V Green Provider	
Master	
Satellite Phone	
Vessel Call Sign	
Thomas Tunstall, Coastal Marine Logistics	+1 [redacted]

CSA Emergency Contact Numbers

CSA	
Satellite Phone-OnBoard Vessel	+1 881-631-614-566
Fred Ayer, CSA Project Manager	+1 [redacted] (Office) +1 [redacted] (Mobile)
Gordon Stevens, CSA Operations	+1 [redacted] (Office) +1 [redacted] (Mobile)
Lynwood Powell, HSE Manager	+1 [redacted] (Office) +1 [redacted] (Mobile)

ENTRIX Emergency Contact Numbers

ENTRIX	
Ryan Holem, HSE Manager	+1 [redacted] (Direct Office) +1 [redacted] (Mobile)

4.0 MEDICAL/FIRST AID PROGRAM

CSA personnel are all properly trained in cardio-pulmonary resuscitation (CPR) and first aid. Training allows CSA personnel to give immediate and temporary care to a victim of an accident or sudden illness until a physician can be obtained. This effective first aid consists of common sense, training, and knowledge of the following:

- Procedures for treating bleeding;
- Procedures for heart attack victims;
- Procedures for choking victims;
- Procedures for treating victims of burns;
- Procedures for treating electric shock victims;
- Procedures for treating victims of exposure to chemicals;
- Procedures for treating victims of inhalation of toxic gas or smoke;
- Procedures for treating shock victims;
- Procedures for treating victims of heat exhaustion;
- Procedures for treating victims of heat stroke;
- Procedures for treating victims of frostbite;
- Procedures for treating victims of hyperthermia; and
- Procedures for treating victims of skin poisoning or swallowed poisons.

5.0 SUBSTANCE ABUSE PROGRAM

CSA is committed to maintaining a drug-free workplace. In recognition of the dangers to our employees and the company of drug abuse in the workplace, and pursuant to the provisions of the U.S. Drug-Free Workplace Act of 1988 and Federal Acquisition Regulation 23.504, all employees are subject to the following:

- Unlawfully manufacturing, distributing, dispensing, possessing, or using a controlled substance is prohibited in the workplace.
- Any employee who unlawfully manufactures, distributes, dispenses, possesses or uses a controlled substance in the workplace will be subject to discipline up to and including dismissal.
- All employees, as a condition of continued employment, must abide by the statement and are required to notify the company of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction.
- This Drug-Free Workplace Statement does not amend, limit, restrict, modify or otherwise alter any other company rules, regulations, procedures or policies.

CSA employees tested for substance abuse must meet the U.S. Department of Transportation (DOT) standards for drug and alcohol testing to be able to work as CSA's representatives on designated projects. The medical forms may be made available for the client's inspection with prior approval from the employee.

DOT regulations require screening for the following drugs (known as the NIDA 5 Panel):

- Marijuana;
- Barbiturates;
- Opiates;
- Amphetamines;
- PCP; and
- Cocaine.

6.0 PERSONAL PROTECTIVE EQUIPMENT SAFETY PROGRAM

The following outlines CSA policy pertaining to the issuance and use of certain personal protective equipment (PPE) that will be issued by CSA. Each employee will be responsible for ensuring his PPE is kept clean and in good working condition.

Protective gear for sampling personnel should include the following:

- a hard hat;
- steel-toe shoe/boots;
- equipment handling and chemical-resistant gloves (e.g., leather or Nitrile);
- safety glasses/goggles;
- respiratory protection;
- rain gear (if necessary);
- coldwater survival gear (if necessary); and
- hearing protection (if safe noise levels are exceeded).

In addition to the above PPE personnel deploying and retrieving equipment over the side of the vessel will be required to wear a safety harness and utilize a retractable lifeline securely connected to a point on the vessel.

It is important to note that the ship's captain has the ultimate responsibility and authority to immediately override the authority of all other on board personnel, especially where the general welfare of crew and vessel are concerned.

During the dockside mobilization, the Site Safety Coordinator will conduct an inventory of the safety-related equipment and materials and provide a report to the Project Scientist and Operation Manager of their status, location, and availability.

Hard Hats. Each employee will be expected to wear a hard hat at all times when working out on deck. These safety hats will meet the specifications contained in American National Standards Institute, Z89.1-1969, Safety Requirements for Industrial Head Protection.

Steel-toed Shoes/Boots. Steel-toed shoes or boots will be required while outside of office area or on any work site, e.g., work deck.

Gloves – Work and Chemical. Work gloves will be provided for handling of equipment and supplies to reduce the potential of hand injuries. Nitrile, rubber, gloves will be provided for the handling of all chemicals and solvents.

Safety Glasses/Goggles. All employees will be issued and must wear approved safety glasses with side shields at all times while in the work area. Those employees who wear prescription glasses will wear safety glasses over their glasses. This also applies to those employees who wear contact lenses.

All employees will be issued and expected to wear 1) approved impact-type goggles with side shields when engaging in any activity that involves hazards to the unprotected eye from chipped or flying particles; and 2) approved splash proof goggles when they are handling hazardous chemical liquids, powders, or vapors as well as when they are in the vicinity of these chemicals.

Employees who wear prescription glasses will wear goggles over their glasses. This also applies to employees who wear contact lenses; these employees must make it apparent that they do wear contact lenses.

Respiratory masks
Protective respiratory mask will be provided to all employees. Any employee handling chemicals or solvents is required to wear a respiratory mask in addition to gloves and goggles.

Protective Outerwear
An outerwear capable of protecting the employee from oily products will be worn during all sampling operations. A Tyvek or suitable alternative is required.

Rain gear
Rain gear is not provided for most offshore surveys. It is the responsibility of the employee to provide adequate protection when working outside of the confines of the vessel.

Cold water survival gear
Cold water survival gear will not be necessary for this survey due to the time of year and the location of the survey area.

Hearing protection
Hearing protection is mandatory in all designated high noise areas. Ear plugs and ear muffs will be provided.

During operations which require special equipment and outerwear, the previously mentioned mandatory equipment and requirements pertaining to the equipment may be voided or amended.

7.0 HEARING CONSERVATION PROGRAM

All employees will wear the appropriate hearing protection provided by CSA while in a high noise area (85 decibels [dBA] or above for an 8-hour time period). A sign will be posted in high noise areas.

The Site Safety Coordinator will ensure any employees working in a high noise area are wearing hearing protection.

CSA also urges its employees to use common sense in a "noisy environment." If it is necessary to shout to communicate, an area is considered a high noise area whether or not signs are posted.

8.0 LIFE SAVING EQUIPMENT

All personnel working or riding on the deck of a boat or barge, or when transferring between vessels or onto a platform, must wear a U.S. Coast Guard (USCG)-approved PFD with reflector tape strips. There will be one PFD for each employee. On-board personnel should familiarize themselves with the ship's man overboard procedures and the vessel's life saving equipment location.

9.0 MOB AND FIRE EMERGENCY PROCEDURES

9.1 MAN OVERBOARD

- Throw a ring buoy overboard as close to the person as possible.
- Notify the personnel on the bridge immediately; bridge records vessel position.
- Post a lookout to keep the person overboard in sight.
- Maneuver the vessel to pick up the person in the water.
- Crew member wearing a PFD attaches a safety line and stands by to jump into the water to assist the person overboard if necessary.
- If person is not immediately located, notify Coast Guard and other vessels in the area by radio telephone.
- Continue search until released by the Coast Guard.

9.2 RULES FOR ABANDONMENT

- Review rules posted on vessel prior to vessel leaving dock.
- Take instructions from vessel's captain and proceed to pre-assigned station on the vessel.

9.3 FIRE ON BOARD

- Review rules posted on vessel prior to vessel leaving dock.
- When alarm sounds proceed to pre-assigned station on the vessel.
- Vessel’s captain will instruct survey team members.

10.0 WATER SURVIVAL PLAN

All employees must become familiar with the use and operation of survival gear and emergency instructions posted on the vessel.

In case of vessel evacuation:

1. Put on a PFD and remove your safety hat.
2. Do not dive into the water but jump in feet first.
3. If swimming in rough water, turn your back to the wind or waves. Keep your head out of water and use a breast stroke.
4. If there is an oil or fuel fire on the water, swim UNDER the water. Before surfacing, use your hands to splash a breathing hole above your head. Close your eyes before surfacing, take a breath, and then resubmerge (feet first).
5. If there is oil and/or debris on the water surface, keep your head up and out of the water. Push the oil/debris away from you as you swim. Protect eyes, nose, and mouth.
6. If swimming in cold water, conserve body heat, and help to prevent hypothermia by minimizing movement.
7. Do not swim to rescuers – let them come to you.

CONSERVE YOUR ENERGY! YOUR SURVIVAL MAY DEPEND ON IT!

11.0 EQUIPMENT INSPECTION PROGRAM

CSA will insure the following equipment is aboard the vessel:

- Fire extinguishers;
- PFDs;
- Safety Harnesses;
- Retractable lifelines;
- Ear protectors;
- Hard hats;
- Safety glasses;
- Safety shoes;
- Organic vapor masks; and
- Protective gloves.

The above equipment shall be inspected daily prior to use for wear and tear and so noted by the designated CSA safety person in his Project Log. During daily inspections, emphasis will be put on equipment security (i.e., safely secured for rough seas), and equipment maintenance.

The safety person will be knowledgeable with U.S. 29 CFR 1926 (Subparts E, F, I, J, K, L, N, and O): Personal Protective and Life Saving Equipment; Fire Protection and Prevention; Tools (Hand/Power); Welding and Cutting; Electrical; Ladders and Scaffolding; Cranes, Derricks, Hoists, Elevators, and Conveyors; Motor Vehicles, Mechanized Equipment, and Marine Operations.

12.0 ELECTRICAL SAFETY PROGRAM

12.1 INSTALLATION AND MAINTENANCE OF ELECTRICAL EQUIPMENT

All installation and maintenance of electrical equipment must comply with the pertinent provisions of the national electrical code. All electrical work will be performed by competent personnel who are familiar with code requirements and qualified for the class of work to be performed. All applicable electrical wire, apparatus, and equipment will be of a type approved by Underwriters Laboratories, Inc., Factory Mutual Engineering Corp., or any other nationally recognized testing laboratory.

12.2 ELECTRICAL ACCIDENT PREVENTION PROCEDURES

The best qualified available employee will be appointed to be the electrical job supervisor. That person will have total responsibility for the electrical work.

Each job should be thoroughly planned, making sure that adequate and proper equipment and sufficient personnel are available to perform the job safely. No job is to be rushed to completion at the expense of safety.

A special safety meeting will be conducted before starting a job to brief all workers involved to make sure all questions are answered and that no confusion exists among the workers.

All possible circuits in the vicinity of the work area should be de-energized and secured in this condition by grounding, locking, and tagging. If it is not possible to de-energize all circuits, use barriers, rubber goods, or any other protective equipment necessary to make the work area safe. Danger signs will be displayed in appropriate locations and on associated equipment as required to afford maximum personnel protection.

Complete attention should be devoted to the job at hand. Preoccupation or day-dreaming cannot be tolerated while working with electrical equipment.

Even low voltage (e.g., 32 volts AC) as well as many battery-powered systems are hazardous and require proper precautions.

All unsafe electrical equipment should be de-energized immediately and tagged "unsafe for use." This action and also notification of inoperable or damaged electrical tools, appliances, etc., should be reported to the immediate supervisor at once. Unqualified persons should not attempt to repair such equipment.

Under no circumstances should the hand or finger be used to test for voltage in a circuit. Only proper and safe test instruments should be used.

In case of an accident or an electrical fire, all power should be cut off immediately. Emergency switches are generally installed at convenient locations to stop electrical machinery. Know where these switches are. Use only fire extinguishers which have been approved for use on an electrical fire. Foamite or other conductive fluids, including water, must not be used on an electrical fire under any circumstances.

Electrical work of any kind will not be performed if an electrical storm is in progress in the immediate vicinity.

Adverse conditions such as darkness, poor weather, isolation, or any abnormal situations may make working alone unduly hazardous. These occasions should be identified by established management guidelines from which the employee can carefully assess the task to be performed and determine whatever assistance might be necessary to perform the job safely. All electrical conductors and equipment will be approved and meet the standards in 29 CFR Subpart K covering the electrical equipment and work practices for this project (copy follows).

13.0 SPILL PREVENTIVE/CLEANUP PLAN

All personnel involved on a project should be aware of all possible polluting situations and take steps to prevent such occurrences.

CSA Operations Managers will insure the MARPOL rules and regulations are posted on the vessel and are followed by all members of the survey team.

Should a spill occur, the following will be available:

- Absorbent pads for use on local spills on vessel and, if necessary, small discharges into the water;
- Absorbent booms for installation around drums and apparatus that could cause a spill on vessel;
- Should portable generators/winches be used that involve fueling, a catchment tray will be provided to prevent gasoline/oil or other fluids from being spilled;
- Shore personnel to locate suitable disposal container close to dock for trash removal from vessel; and
- Trash bags and ties for general trash storage will be provided on vessel.

In case of large spills, the vessel is to cease operations, stay in the area and call in to the local client base, local Coast Guard, or other appropriate regulatory agency.

PICK UP ANY TRASH YOU SEE -- NOT JUST YOUR OWN.
AND REMEMBER NO TRASH/DEBRIS/WASTE/POLLUTANT IS TO BE DEPOSITED ANYWHERE BUT IN THE CORRECT RECEPTACLE.

14.0 SHORT-TERM EMPLOYEE PROGRAM

Any CSA employees that have been with the company less than six months will be identified as "Short-Term Employees" to all personnel including the client or its agent prior to start-up and mobilization of project.

Short-term employees will be given a job-specific orientation prior to the general job safety meeting dealing with the client's site safety expectations and procedures and hands-on training by CSA for upcoming job assignments.

Short-term employees will expect to be given special supervision during their 90-day probationary period with the orientation reinforced at the end of their first week's employment with CSA and at the end of their first month's employment. The employee will then be evaluated by their supervisor monthly for the next three months. It is implied here and to be understood by the short-term employee that he will be teamed with an experienced employee whenever possible. Under no circumstances will two short-term employees be teamed on a job without approval.

APPENDIX

APPENDIX A

Hazards Analysis/Risk Assessment

HAZARDS ANALYSIS/RISK ASSESSMENT

Hazard	Consequences/Risk	Severity	Safeguard(s)/Control Measure(s)	Risk Matrix		Recommendations	Responsibility	Status
				Likelihood	Risk Rank			
Lifting accidents, dropped equipment	Injuries, damage to or loss of equipment/material	Major	Lifting procedures, lift plan, worker awareness, qualified/experienced personnel	Remote	B	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Boarding/loading boats	Trips, falls, injuries, damage to or loss of equipment	Minor	Designated boarding/ loading areas and procedures, first aid, clear work procedures	Infrequent	A	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Navigation and positioning control	Wrong locations, work delays, impact to work productivity	Moderate	Obtain latest nautical charts, set up and check CSA vessel GPS navigation during mobilization, prepare pre-plots, provide accurate locations, provide coordinates in a digital exchange file	Remote	B	Confirm accuracy of coordinates through backup GPS	Project Scientist	Open
Deployment/handling of sample collection equipment	Pinching injury, impact/crushing injury, entanglement, MOB	Moderate	Worker training, established procedures, work gloves, HSE briefing	Infrequent	B	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Man overboard (MOB)	Loss of personnel	Major	PFDs, work deck rules, safety chain, MOB procedures	Infrequent	C	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
General health and safety (offshore/on water)	Heat exhaustion and overheating, exposure, dehydration, minor injuries	Moderate	Adequate drinking water available, sunscreen, light clothing, clear decks, designated work areas and clear work procedures, first aid	Infrequent	B	Review during HSE induction	Operations Supervisor	Open
Spillage of fuels, oils, and lubricants	Environmental degradation, regulatory fines, damage to reputation	Major	Refueling on land or in port only, adequate capacity for full-day operations	Infrequent	C	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
General health and safety (onshore)	Exposure, dehydration, minor injury	Moderate	Adequate shade, adequate drinking water available, sunscreen, light clothing, clear/designated work areas, clear work procedures, work breaks	Infrequent	B	Review during HSE induction	Operations Supervisor	Open
Road/driving accidents	Collisions, damage to vehicles or equipment, injury	Major	Use of licensed and experienced drivers, safe driving at posted speeds, seatbelts	Remote	B	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open

Hazard	Consequences/Risk	Severity	Safeguard(s)/Control Measure(s)	Risk Matrix		Recommendations	Responsibility	Status
				Likelihood	Risk Rank			
Food-/water-/blood-borne pathogens	Debilitating illness, impacts to productivity	Moderate	Worker training, HSE briefing, emergency response plan	Infrequent	B	Review during HSE induction	Operations Supervisor	Open
Unsafe weather/sea state conditions	Damage to vessels	Major	Weather forecast reviews, continuous monitoring of local weather, ongoing communications, delay/cancel/abort weather thresholds	Remote	B	Conduct continuous monitoring of weather while on site, morning forecast reviews and postpone mobilization if predicted to exceed limitations	Operations Supervisor	Open
Rough sea conditions	Injuries, MOB, damage to or loss of equipment/materials	Moderate	Check for secure deck and equipment/materials before getting underway, use of PFDs	Infrequent	B	Cross check for clear deck prior to getting underway	Operations Supervisor	Open
Vessel mechanical failure or damage	Loss of vessel, vessel adrift, stranded divers	Major	Rigorous vessel maintenance and inspection, standby vessel, float plan, established communications	Remote	B	Ensure valid vessel inspections, pre-day vessel checklists	Vessel Master	Open
Unsafe deck conditions (e.g., wet, cluttered)	Slips, trips, falls, MOB, damage to equipment	Major	Clear decks, designated work areas, clear work procedures, emergency response plan	Frequent	D	Review procedures and PPE requirements in toolbox meeting prior to activity; install safety line across stern	Vessel Master	Open
Underwater obstructions, contact with bottom, grounding	Damage to seabed features/organisms, damage to boats/ equipment, injuries	Major	Review of nautical charts, mapping of navigation hazards, experienced boat operators	Remote	B	Review transit route for obstructions, shallow water	Vessel Master	Open
Other vessel/traffic shipping	Collisions	Major	Deck watch	Remote	B	Review of shipping patterns, contact any vessels in vicinity	Vessel Master	Open
Medical emergencies (injured/unconscious worker), limited timely medical access/support	Lack of/late medical attention leading to medical complications, possibly disablement/ fatality	Major	Emergency procedures for worker extraction, established communications to shore, standby vessel, local emergency support, emergency response plan, emergency oxygen on-board, comprehensive first aid equipment	Remote	B	Prior arrangements with Port/ambulance, advice to Navy and/or Coast Guard; post-emergency contact infomation readily available on all vessels/boats	Operations Supervisor	Open
Emergency preparedness	Inadequate response to emergencies	Minor	Conduct weekly drills, HSE inspection to review emergency systems	Infrequent	A	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open

Hazard	Consequences/Risk	Severity	Safeguard(s)/Control Measure(s)	Risk Matrix		Recommendations	Responsibility	Status
				Likelihood	Risk Rank			
Confined Space Entry	Loss of consciousness, fatality, impact to work productivity	Major	Real-time air monitoring, forced air ventilation, full body harness, rescue tri-pod	Remote	B	Review procedures in toolbox meeting prior to activity	Site Safety Officer	Open

APPENDIX B

MSDS for Project chemicals

Project Chemicals:

Liquinox

Isopropyl Alcohol

Hexane

LIQUINOX MSDS

Section 1 : PRODUCT AND COMPANY IDENTIFICATION

Chemical family: Detergent.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: [redacted].
[redacted] (outside of the United States).

Supplier: Same as manufacturer.

Product name: Liquinox

Section 2 : INGREDIENT INFORMATION

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE

Section 3 : HAZARD IDENTIFICATION

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Effects of acute exposure

Eye contact: May cause irritation.

Skin contact: Prolonged and repeated contact may cause irritation.

Inhalation: May cause headache and nausea.

Ingestion: May cause vomiting and diarrhea.
May cause gastric distress.

Effects of chronic exposure: See effects of acute exposure.

Section 4 : FIRST AID MEASURES

Skin contact: Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

Inhalation: Remove victim to fresh air.
If irritation persists, seek medical attention.

Ingestion: Do not induce vomiting, seek medical attention.
Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.

Section 5 : FIRE FIGHTING MEASURES

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.
Use water spray to cool fire exposed containers.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Explosion Data

Sensitivity to static discharge: Not available.

Sensitivity to mechanical impact: Not available.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: Containers may rupture if exposed to heat or fire.

Section 6 : ACCIDENTAL RELEASE MEASURES

Leak/Spill: Contain the spill.
Prevent entry into drains, sewers, and other waterways.
Wear appropriate protective equipment.
Small amounts may be flushed to sewer with water.
Soak up with an absorbent material.
Place in appropriate container for disposal.
Notify the appropriate authorities as required.

Section 7 : HANDLING AND STORAGE

Handling procedures and equipment: Protect against physical damage.
Avoid breathing vapors/mists.
Wear personal protective equipment appropriate to task.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Avoid extreme temperatures.
Launder contaminated clothing prior to reuse.

Storage requirements: Store away from incompatible materials.
Keep containers closed when not in use.

Section 8 : EXPOSURE CONTROLS / PERSONAL PROTECTION

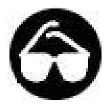
Precautionary Measures

Gloves/Type:

Wear appropriate gloves.

Respiratory/Type: None required under normal use.

Eye/Type:



Safety glasses recommended.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

Exposure limit of material: Not available.

Section 9 : PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid.

Appearance & odor: Odourless.
Pale yellow.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 20°C (68°F).
17

Vapour density (air=1): >1

Volatiles (%)

By volume: Not available.

Evaporation rate (butyl acetate = 1): < 1.

Boiling point (°C): 100 (212F)

Freezing point (°C): Not available.

pH: 8.5

Specific gravity @ 20 °C: (water = 1).
1.083

Solubility in water (%): Complete.

Coefficient of water\oil dist.: Not available.

VOC: None

Chemical family: Detergent.

Section 10 : STABILITY AND REACTIVITY

Chemical stability: Product is stable under normal handling and storage conditions.

Conditions of instability: Extreme temperatures.

Hazardous polymerization:	Will not occur.
Incompatible substances:	Strong acids. Strong oxidizing agents.
Hazardous decomposition products:	See hazardous combustion products.

Section 11 : TOXICOLOGICAL INFORMATION

LD50 of product, species & route:	> 5000 mg/kg rat oral.
LC50 of product, species & route:	Not available.
Sensitization to product:	Not available.
Carcinogenic effects:	Not listed as a carcinogen.
Reproductive effects:	Not available.
Teratogenicity:	Not available.
Mutagenicity:	Not available.
Synergistic materials:	Not available.

Section 12 : ECOLOGICAL INFORMATION

Environmental toxicity:	No data at this time.
Environmental fate:	No data at this time.

Section 13 : DISPOSAL CONSIDERATIONS

Waste disposal:	In accordance with local and federal regulations.

Section 14 : TRANSPORT INFORMATION

D.O.T. CLASSIFICATION:	Not regulated.
Special shipping information:	Not regulated.

Section 15 : REGULATORY INFORMATION

Canadian Regulatory Information	
WHMIS classification:	Not controlled.
DSL status:	Not available.
USA Regulatory Information	
SARA hazard catagories sections 311/312:	Immediate (Acute) Health Hazard: No. Delayed (Chronic) Health Hazard: No. Fire Hazard: No. Sudden Release of Pressure: No. Reactive: No.
SARA Section 313:	None
TSCA inventory:	All components of this product are listed on the TSCA inventory.

NFPA
Health Hazard: 1
Flammability: 0
Reactivity: 0
HMIS
Health Hazard: 1
Flammability: 0
Physical hazard: 0
PPE: A

Section 16 : OTHER INFORMATION

Supplier MSDS date: 2006/07/14

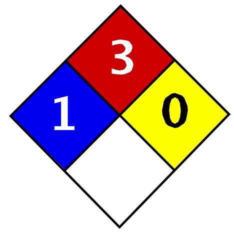
Data prepared by: Global Safety Management
3340 Peachtree Road, #1800
Atlanta, GA 30326

Phone: [redacted]
Fax: [redacted]

Web: www.globalsafetynet.com
Email: info@globalsafetynet.com.

General note: This material safety data sheet was prepared from information obtained from various sources, including product suppliers and the Canadian Center for Occupational Health and Safety.

ScienceLab.com
Chemicals & Laboratory Equipment



Health	2
Fire	3
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Isopropyl Alcohol, 70% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Isopropyl Alcohol, 70%

Catalog Codes: SLI1669

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Isopropyl alcohol; Water

CI#: Not available.

Synonym: 2-Propanol, 70%; Isoprpanol, 70%; Isopropyl Rubbing Alcohol

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-**[redacted]
International Sales: **1-**[redacted]

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-[redacted]

International CHEMTREC, call: 1-[redacted]

For non-emergency assistance, call: 1-[redacted]

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Isopropyl alcohol	67-63-0	70
Water	7732-18-5	30

Toxicological Data on Ingredients: Isopropyl alcohol: ORAL (LD50): Acute: 5045 mg/kg [Rat]. 3600 mg/kg [Mouse]. 6410 mg/kg [Rabbit]. DERMAL (LD50): Acute: 12800 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, . Slightly hazardous in case of skin contact (sensitizer, permeator). Non-corrosive for skin. Non-corrosive to the eyes. Non-corrosive for lungs.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC [Isopropyl alcohol].
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Development toxin [POSSIBLE] [Isopropyl alcohol].

The substance may be toxic to kidneys, liver, skin, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: The lowest known value is 399°C (750.2°F) (Isopropyl alcohol).

Flash Points: CLOSED CUP: 18.3°C (64.9°F) - 24 deg. C (75 deg. F)

Flammable Limits: The greatest known range is LOWER: 2% UPPER: 12.7% (Isopropyl alcohol)

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat.
Flammable in presence of oxidizing materials.
Non-flammable in presence of shocks

Explosion Hazards in Presence of Various Substances:
Slightly explosive in presence of open flames and sparks, of heat.
Non-explosive in presence of shocks.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Vapor may travel considerable distance to source of ignition and flash back. CAUTION: MAY BURN WITH NEAR INVISIBLE FLAME.
Hydrogen peroxide sharply reduces the autoignition temperature of Isopropyl alcohol.
After a delay, Isopropyl alcohol ignites on contact with dioxgenyl tetrafluorborate, chromium trioxide, and potassium tert-butoxide. When heated to decomposition it emits acrid smoke and fumes. (Isopropyl alcohol)

Special Remarks on Explosion Hazards:
Secondary alcohols are readily autooxidized in contact with oxygen or air, forming ketones and hydrogen peroxide.
It can become potentially explosive.
It reacts with oxygen to form dangerously unstable peroxides which can concentrate and explode during distillation or evaporation. The presence of 2-butanone increases the reaction rate for peroxide formation.
Explosive in the form of vapor when exposed to heat or flame. May form explosive mixtures with air.
Isopropyl alcohol + phosgene forms isopropyl chloroformate and hydrogen chloride.
In the presence of iron salts, thermal decompositon can occur, whicn in some cases can become explosive.
A homogeneous mixture of concentrated peroxides + isopropyl alcohol are capable of detonation by shock or heat.
Barium perchlorate + isopropyl alcohol gives the highly explosive alkyl perchlorates.
It forms explosive mixtures with trinitormethane and hydrogen peroxide.
It produces a violent explosive reaction when heated with aluminum isopropoxide + crotonaldehyde.
Mixtures of isopropyl alcohol + nitroform are explosive.
(Isopropyl alcohol)

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves (impervious).

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
Isopropyl alcohol
TWA: 983 STEL: 1230 (mg/m3) [Australia]
TWA: 200 STEL: 400 (ppm) from ACGIH (TLV) [United States] [1999]
TWA: 980 STEL: 1225 (mg/m3) from NIOSH
TWA: 400 STEL: 500 (ppm) from NIOSH
TWA: 400 STEL: 500 (ppm) [United Kingdom (UK)]
TWA: 999 STEL: 1259 (mg/m3) [United Kingdom (UK)]
TWA: 400 STEL: 500 (ppm) from OSHA (PEL) [United States]
TWA: 980 STEL: 1225 (mg/m3) from OSHA (PEL) [United States]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Alcohol like.

Taste: Not available.

Molecular Weight: Not applicable.

Color: Clear Colorless.

pH (1% soln/water): Neutral.

Boiling Point: The lowest known value is 82.5°C (180.5°F) (Isopropyl alcohol). Weighted average: 87.75°C (189.9°F)

Melting Point: May start to solidify at -88.5°C (-127.3°F) based on data for: Isopropyl alcohol.

Critical Temperature: The lowest known value is 235°C (455°F) (Isopropyl alcohol).

Specific Gravity: Weighted average: 0.84 (Water = 1)

Vapor Pressure: The highest known value is 4.4 kPa (@ 20°C) (Isopropyl alcohol). Weighted average: 3.77 kPa (@ 20°C)

Vapor Density: The highest known value is 2.07 (Air = 1) (Isopropyl alcohol). Weighted average: 1.63 (Air = 1)

Volatility: Not available.

Odor Threshold: The highest known value is 22 ppm (Isopropyl alcohol)

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, n-octanol, acetone.

Solubility: Easily soluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, flame, ignition sources, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts violently with hydrogen + palladium combination, nitroform, oleum, COCl2, aluminum triisopropoxide, oxidants
Incompatible with acetaldehyde, chlorine, ethylene oxide, isocyanates, acids, alkaline earth, alkali metals, caustics, amines, crotonaldehyde, phosgene, ammonia.
Isopropyl alcohol reacts with metallic aluminum at high temperatures.
Isopropyl alcohol attacks some plastics, rubber, and coatings.
Vigorous reaction with sodium dichromate + sulfuric acid. (Isopropyl alcohol)

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 5143 mg/kg (Mouse) (Calculated value for the mixture).
Acute dermal toxicity (LD50): 18286 mg/kg (Rabbit) (Calculated value for the mixture).

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC [Isopropyl alcohol].
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Development toxin [POSSIBLE] [Isopropyl alcohol].
Contains material which may cause damage to the following organs: kidneys, liver, skin, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Slightly hazardous in case of skin contact (sensitizer, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
M a y c a u s e a d v e r s e r e p r o d u c t i v e / t e r a t o g e n i c e f f e c t s (f e r t i l i t y , f e t o x i c i t y , d e v e l o p m e n t a l
abnormalities(developmental toxin)) based on animal studies.
Detected in maternal milk in human. (Isopropyl alcohol)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause mild skin irritation, and sensitization.
Eyes: Can cause eye irritation.
Inhalation: Breathing in small amounts of this material during normal handling is not likely to cause harmful effects. However, breathing large amounts may be harmful and may affect the respiratory system and mucous membranes (irritation), behavior and brain (Central nervous system depression - headache, dizziness, drowsiness, stupor, incoordination, unconciousness, coma and possible death), peripheral nerve and senstation, blood, urinary system, and liver.
Ingestion: Swallowing small amouts during normal handling is not likely to cause harmful effects. Swallowing large amounts may be harmful. Swallowing large amounts may cause gastrointestinal tract irritation with nausea, vomiting and diarrhea, abdominal pain. It also may affect the urinary system, cardiovascular system, sense

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Isopropanol, solution (Isopropyl alcohol) UNNA: 1219 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Isopropyl alcohol
Illinois toxic substances disclosure to employee act: Isopropyl alcohol
Rhode Island RTK hazardous substances: Isopropyl alcohol
Pennsylvania RTK: Isopropyl alcohol
Florida: Isopropyl alcohol
Minnesota: Isopropyl alcohol
Massachusetts RTK: Isopropyl alcohol
New Jersey: Isopropyl alcohol
New Jersey spill list: Isopropyl alcohol
TSCA 8(b) inventory: Isopropyl alcohol; Water
TSCA 4(a) final testing order: Isopropyl alcohol
TSCA 8(a) IUR: Isopropyl alcohol
TSCA 8(d) H and S data reporting: Isopropyl alcohol: Effective date: 12/15/86 Sunset Date: 12/15/96
TSCA 12(b) one time export: Isopropyl alcohol
SARA 313 toxic chemical notification and release reporting: Isopropyl alcohol 70%

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable.
R36- Irritating to eyes.

S2- Keep out of the reach of children.
S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves (impervious).
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:53 PM

Last Updated: 11/06/2008 12:00 PM

Material Safety Data Sheet
Instant FAME/Instant Anaerobe Methods
Hexane

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MSDS Name: Hexane
MSDS Preparation Date: 06/19/2009
Synonyms or Generic ID: n-Hexane, Hexyl-hydride, Dipropyl, normal-Hexane, Hex.
PIN (UN#/ NA#): UN1208
Company Identification:
Microbial ID
125 Sandy Drive
Newark Delaware 19711
For Information, call: [redacted], [redacted]
For Domestic CHEMTREC assistance, call: [redacted]
For International CHEMTREC assistance, call: [redacted]

SECTION 2 – COMPOSITION, INFORMATION ON INGREDIENTS

CAS #	Chemical Name	Percent	EINECS/ELINCS	ACGIH TLV	Hazards
110-54-3	Hexane (contains a mixture of isomers)	100	203-777-6	50 ppm	Flammable, mild irritant

State: Liquid	Appearance: colorless	Odor: Gasoline Like
Boiling Point (C): 62-69°C 760mm HG	pH: not available	Specific Gravity: 0.678
Vapor Pressure (mm Hg): 151mm Hg @ 25°C	Vapor Density (AIR=1): 2.97	
Solubility in Water: insoluble		

SECTION 3 – HAZARDS IDENTIFICATION

Appearance: clear, colorless.

DANGER! Extremely flammable liquid and vapor. Vapor may cause flash fire. Breathing vapors may cause drowsiness and dizziness. Causes eye, skin, and respiratory tract irritation. May be harmful if absorbed through the skin. Aspiration hazard if swallowed. Can enter lungs and cause damage. Possible risk of impaired fertility. Long-term exposure may cause damage to the nervous system of the extremities (the hands, arms, legs and feet). Dangerous for the environment.
Target Organs: Central nervous system, respiratory system, eyes, skin, peripheral nervous system, testes.

Potential Health Effects
Eye: Causes mild eye irritation.
Skin: Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. Causes irritation with burning pain, itching, and redness. Absorbed through the skin. There have been no reports of skin sensitization in people occupationally exposed to n-hexane. Skin sensitization was not observed in a maximization test using 25 volunteers.
Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal. May cause central nervous system depression.
Inhalation: Causes respiratory tract irritation. Exposure produces central nervous system depression. Vapors may cause dizziness or suffocation. n-Hexane vapor concentrations can become so high that oxygen is displaced, especially in confined spaces.

Chronic: Prolonged or repeated skin contact may cause defatting and dermatitis. Prolonged or repeated exposure may cause adverse reproductive effects. Chronic exposure may cause visual disturbances. Laboratory experiments have resulted in mutagenic effects. Peripheral neuropathy symptoms include: muscular weakness, paresthesia, numbing of the hands, feet, legs and arms, unsteadiness, and difficulty in walking and standing. Repeated exposure may cause nervous system abnormalities with muscle weakness and damage, motor incoordination, and sensation disturbances. Chronic exposure produces peripheral neuropathy.

SECTION 4 – FIRST AID MEASURES

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If vomiting occurs naturally, have victim lean forward.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively. For ingestion, the stomach should be intubated, aspirated, and lavaged with a slurry of activated charcoal--protect the airway from aspiration of gastric contents. Monitor arterial blood gases in cases of severe aspiration.

SECTION 5 – FIRE FIGHTING MEASURES

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. May accumulate static electrical charges, and may cause ignition of its own vapors. Extremely flammable liquid and vapor. Vapor may cause flash fire. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. This liquid floats on water and may travel to a source of ignition and spread fire.
Extinguishing Media: Use dry chemical, carbon dioxide, or appropriate foam. Solid streams of water may be ineffective and spread material. Water may be ineffective because it will not cool material below its flash point.
Flash Point: -7.6 to -15°C
Autoignition Temperature: 225 deg C (437.00°F)
Explosion Limits, Lower:1.2 vol %
Upper: 7.7 vol %
NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

SECTION 6 – ACCIDENTAL RELEASE MEASURES

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Large spills may be neutralized with dilute alkaline solutions of soda ash, or lime. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Provide ventilation. Do not get water inside containers. A vapor suppressing foam may be used to reduce vapors. Absorb spill using an absorbent, non-combustible material such as earth, sand or vermiculite.

SECTION 7-HANDLING AND STORAGE

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Take precautionary measures against static discharges. Keep away from heat, sparks and flame. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Avoid breathing vapor or mist.
Storage: Keep away from heat and flame. Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well ventilated area away from incompatible substances.

SECTION 8 – EXPOSURE CONTROL/ PERSONAL PROTECTION

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local explosion-proof ventilation to keep airborne levels to acceptable levels.

Exposure limits:

Chemical Name	ACGH	NIOSH	OSHA
Hexane (contains a mixture of isomers)	50 ppm TWA; Skin-potential significant contribution to overall exposure by the cutaneous route	50 ppm TWA; 180 mg/m3 TWA 1100 ppm IDLH	500 ppm TWA; 1800 mg/m3 TWA

OSHA Vacated PELs: Hexane (contains a mixture of isomers): 50 ppm TWA; 180 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear chemical splash goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respiratory use.

Other Protective Equipment: Make eye bath and emergency shower available.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Appearance: Clear colorless
Odor: Gasoline-like
pH: Not available.
Vapor Pressure: 151 mm Hg @ 25°C
Vapor Density: 2.97(Air = 1)
Evaporation Rate: Not available.
Viscosity: 0.31 mPas 20°C
Boiling Point: 62 - 69°C @ 760 mmHg
Freezing/Melting Point:-95 °C
Decomposition Temperature: Not available.
Solubility: Insoluble.
Specific Gravity/Density:0.678
Molecular Formula:C_6H_{14}
Molecular Weight:86.18

SECTON 10 – STABILITY AND REACTIVITY

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Ignition sources, excess heat, electrical sparks, confined spaces.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Will not occur.

SECTION 11 – TOXICOLOGICAL INFORMATION

CAS# 110-54-3: MN9275000
LD50/LC50:
CAS# 110-54-3:
  Draize test, rabbit, eye: 10 mg Mild;
  Inhalation, mouse: LC50 = 150000 mg/m3/2H;
  Inhalation, rat: LC50 = 48000 ppm/4H;
  Inhalation, rat: LC50 = 627000 mg/m3/3M;
  Oral, rat: LD50 = 25 gm/kg;
Carcinogenicity:
CAS# 110-54-3: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
Epidemiology: Occupational polyneuropathy has resulted from hexane exposures as low as 500 ppm, but the minimum levels of n-hexane that are neurotoxic in humans haven't been established. Nearly continuous exposure of animals at 250 ppm has caused neurotoxic effects.
Teratogenicity: No evidence of teratogenicity or embryotoxicity in anmial studies with hexane. Fetotoxicity has been observed in the presence of maternal toxicity.
Reproductive Effects: Severe testicular damage has been observed in rats exposed to hexane at concentrations which have produced other significant toxicity. Although subneurotoxic doses of its principle toxic metabolite, 2,5-hexanedione, can induce progressive testiculartoxicity in rats, there have been no reports of human sterility or other reproductive toxicity associated with n-hexane exposures.
Mutagenicity: Positive results (chromosomal damage in the bone marrow cells) obtained for rats exposed by inhalation to n-hexane.
Neurotoxicity: n-Hexane is a mild irritant and CNS depressant in acute exposure, but its principal effects are damage to the sensory and motor peripheral nerves, particularly in chronic exposure.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity: No data available. Estimated BCF values = 2.24 and 2.89. These values suggest that hexane will show low bioconcentration in aquatic organisms. Estimated Koc value = 4.11. This product will show slight soil mobility and is expected to rapidly volatilize from moist surface soils.
Environmental: Terrestrial: Volatilization and adsorption are expected to be the most important fate processes. Aquatic: Photolysis or hydrolysis are not expected to be important. Atmospheric: Expected to exist entirely in the vapor phase in ambient air, expected half life 2.8 days. Expected to biodegrade but not bioconcentrate.
Physical: No information available.
Other: No information available.

SECTION 13 – DISPOSAL CONSIDERATIONS

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

SECTION 14 – TRANSPORT INFORMATION

Proper Shipping Name: Hexanes
Hazard Class: 3
UN Number: UN1208
Packing Group: II
Flash Point: -22

SECTION 15 – REGULATORY INFORMATION

US FEDERAL
TSCA
CAS# 110-54-3 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 110-54-3: 5000 lb final RQ; 2270 kg final RQ.
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 110-54-3: immediate, delayed, fire.
Section 313
This material contains Hexane (contains a mixture of (CAS# 110-54-3, 100%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Parts 261.3
Clean Air Act:
CAS# 110-54-3 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 110-54-3 can be found on the following state right to know lists: New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols:
XN F N
Risk Phrases:
R 11 Highly flammable.
R 38 Irritating to skin.
R 48/20 Harmful : danger of serious damage to health by prolonged exposure through inhalation.
R 62 Possible risk of impaired fertility.
R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R 65 Harmful: may cause lung damage if swallowed.
R 67 Vapours may cause drowsiness and dizziness.

Safety Phrases:
S 16 Keep away from sources of ignition - No smoking.
S 29 Do not empty into drains.
S 33 Take precautionary measures against static discharges.
S 36/37 Wear suitable protective clothing and gloves.
S 9 Keep container in a well-ventilated place.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.
S 62 If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

WGK (Water Danger/Protection)
CAS# 110-54-3: 1
Canada - DSL/NDSL
CAS# 110-54-3 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of B2, D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
Canadian Ingredient Disclosure List
CAS# 110-54-3 is listed on the Canadian Ingredient Disclosure List.

SECTION 16 – Other Information

This Material Safety Data Sheet has been prepared in accordance with 29 CFR 1910.1200 and contains information believed to be accurate and complete at the date of preparation. The statements contained herein are offered for informational purposes only. MIDI Inc. believes them to be accurate but does not purport to be all-inclusive. The above-stated product is intended for use only by persons having the necessary technical skills and facilities for handling the product at their discretion and risk. Since conditions and manner of use are outside our control, we (MIDI Inc.) make no warranty of merchantability or any such warranty, express or implied with respect to information and we assume no liability resulting from the above product or its use. Users should make their own investigations to determine suitability of information and product for their particular purposes.

APPENDIX C

FORMS

Pre-Mobilization Safety Briefing

HSE Indoctrination Record

Job Safety Hazard Analysis

Hazard Analysis/Risk Assessment Acknowledgement

Daily Safety Meeting

Incident/Accident Notification

Next of Kin Information

Daily Survey Report

Management of Change Order

CSA INTERNATIONAL, INC.
PRE-MOBILIZATION SAFETY BRIEFING (PMSB)

A PMSB will be conducted by the CSA Site Safety Coordinator

The following is a summary of items to be discussed:

1) Description of project and goals
   - Sediment & Water collection, hydrographic profiler casts, ADCP, ROV Ops
2) Communications – key to acquiring goals
   - Accident prevention - safe and healthy environment
3) Team members, assignments, and shifts
   - CSA, ENTRIX, and M/V Green Provider crew
4) Coordination with boat driver/vessel's crew
   - Efficient procedures
   - Emergencies - medical, fire, man overboard (MOB), abandon ship
5) Designation of person in charge on deck
   - Shift leader
6) Complexity of the operations
   - Mobilization, Field, Demobilization
   - Collection Processes
7) Pre-operation checks
   - Vessel preparation
   - Location of vessel safety equipment
8) Safety equipment
   - Vessel
   - Sampling
   - First-aid
9) Hazards
   - Vessel operations
   - Sampling operations
   - Vessel and equipment: slips, trips, falls, bumps, pinching;
10) Limitations of personnel and equipment
   - Lifting, rigging, and safe working loads
   - Personal protective equipment
11) Environmental conditions
   - Wind, sea state, etc.

The PMSB/HSE induction for all personnel involved with the field activities will be conducted prior to vessel mobilization. Daily briefings will be conducted for survey personnel. All vessel crew members will be briefed on the operation of all primary and support equipment and primary sampling equipment (especially the winch, blocks, cable, and A-frame) prior to mobilization. It is the responsibility of the survey team members to ensure that proper rigging and lifting procedures are used. The vessels' Masters will be responsible for conducting the following drills: MOB, fire, abandon ship, and medical emergency. These drills will be conducted once before the survey begins and weekly thereafter.

CSA INTERNATIONAL, INC.

**HEALTH, SAFETY, AND ENVIRONMENTAL
INDOCTRINATION RECORD**

Name:

Date:

Employer:

I have received indoctrination and training for following:

1. Company safety policies of CSA, ENTRIX, and CML safety requirements, and the names of persons assigned to safety supervision duties.

2. Requirements and my individual responsibilities for accident prevention, maintaining a safe and healthy work environment, preventing damage to property, and protecting safety of others.

3. Provisions for medical facilities and procedures for reporting or correcting unsafe conditions and practices, and reporting accidents.

4. Job hazards and means used to control or eliminate those hazards, including applicable "Job Safety Analyses (JSA)" (major activity, locations, hazards, controls).

5. Accident Reporting - Both my individual and my Supervisor's responsibilities for reporting all accidents, even minor.

6. Sanitation - Water, toilet facilities.

7. Medical Facilities - Location of nearest medical emergency facilities, emergency phone numbers, first-aid kits and material data safety sheets.

8. Emergency Plans – man overboard, fire, medical, severe weather, spill response, and other emergency procedures.

9. Personal protective equipment.

10. Daily housekeeping requirements.

11. Fire prevention.

12. Policy on use of ropes, slings, and chains.

13. Hazards of floor and wall openings.
14. Hearing protection.
15. Requirements when working around hot substances.
16. Precautions with welding, cutting, and grounding of machinery.
17. Temporary electrical requirements.
18. Proper use of hand tools and power tools.
19. Proper precautions with compressed gas cylinders.
20. Requirements for ramps, runways, platforms, and scaffolds.
21. Clear access and ladder safety.
22. Material handling, storage, and disposal.
23. Hazardous materials.
24. If I am injured I (do) (do not) want the following person notified:

Name:

Phone:

Signature: ___________________________ Date ________________

Safety Officer Signature: ________________________ Date ________________

CSA INTERNATIONAL, INC.

JOB SAFETY HAZARD ANALYSIS FORM

JOB TITLE:	**JSHA No.____**	**Page___of___**	**DATE**: **New___** **Revised___**
Employer: **Facility**: **Location**:	**Classification(s) Doing Job**: **Supervisor**:	**Required /Recommended Personal Protective Equipment**:	**Analysis by**: **Reviewed by**: **Approved by**:

Sequence of Basic Job Steps	Potential Hazards	Recommended Action or Procedure

CSA INTERNATIONAL, INC.

HAZARDS ANALYSIS/RISK ASSESSMENT ACKNOWLEDGEMENT

My supervisor has reviewed this hazard analysis with me, and I understand the hazards and required precautionary actions. I will follow the requirements of this hazard analysis or notify my supervisor if I am unable to do so. I understand that there are Environmental, Safety, and Health professionals on staff if I need further assistance or clarification.

Name (please print)	Signature	Date

CSA INTERNATIONAL, INC.

DAILY SAFETY MEETING FORM

DATE:_____________

PROJECT TITLE:____

CONDUCTED BY:____

IN ATTENDANCE: **Print Name** **Sign Name**

SUBJECT(S) DISCUSSED: **Potential Safety Hazards and Resolutions**

INCIDENT/ACCIDENT NOTIFICATION FORM Directions for filling out form

Email within 24 hrs to – Lynwood Powell, CSA Stuart Office – lpowell@conshelf.com

Originators Reference No: ***Number assigned by project/asset as in its incident summary***		
Date of Incident:	**Time:**	**Exact Location**: **Location of the incident/Project Group**
Name of Person(s) involved: ***Injured party, any other people involved***		
Employing Company: ***Injured party and all people involved***		
Type of Incident: ***LTI, Near Miss, RWC, Medical Treatment, etc.***		
Initial Potential Consequence: ***Assign initial potential consequence as per The Risk Assessment Matrix***		
Description of Incident:	Where, when, what, how, who, operation in progress at the time (only factual)	

Provide details of the incident including:

- ***timing,***
- ***order of events,***
- ***Personnel involved their position, company, etc.***
- ***their role in the incident,***
- ***any relevant information available at the time of reporting***
- ***medical/emergency response details***
- ***any other important information***

Immediate Action: Immediate remedial action and actions to prevent reoccurrence or escalation

In this section provide only immediate remedial actions (corrective) and actions TO PREVENT REOCCURRENCE. Do not include medical response into this section

Remedial Actions:

Provide long term remedial actions (if identified at the stage of reporting). For the incidents requiring further investigation do not include remedial actions. Those will have to be reported as a part of a final investigation report

Name: **Title:** **Date:**

Signature:

CSA International, Inc.

INCIDENT NOTIFICATION FORM

E-mail/Fax within 24 hrs to – Lynwood Powell, CSA Stuart Office – lpowell@conshelf.com

Originators Reference No:		**Project/Asset Group:**
Date of Incident:	**Time:**	**Exact Location**:
Client/Employing Company:		
Type of Incident:		
Initial Potential Consequence:		
Description of Incident: Where, when, what, how, who, and the operation in progress at the time (only factual).		
Immediate Action: Immediate remedial action and actions to prevent reoccurrence or escalation.		
Remedial Actions:		

Name: **Title:** **Date:**

Signature:

CSA International, Inc.

NEXT-OF-KIN INFORMATION

Person	Name	Relationship	Phone
Bruce Graham	Joey Graham	Spouse	[redacted]
Frank Johnson	Beth Johnson	Spouse	[redacted]
Tony Wadley	Pauline Wadley	Mother	[redacted]
Terry Stevens	Sue Stevens	Mother	[redacted]

CSA INTERNATIONAL, INC.
DAILY SURVEY REPORT

Client: ENTRIX
Project: Water Column Profiling Survey
Location: GOM; MC Block 252
Job Number: CSA-2290
Date:

Weather Report

Vessel: M/V Green Provider
Client Rep:
Current location:
Satellite Phone #:
Onboard Email:

Wind speed/dir:
Wave height:
General:

PERSONNEL ON BOARD

CSA	*Client*	*Vessel*

CSA INTERNATIONAL, INC.

Daily Survey Report (*Cont'd*)

SAMPLE SUMMARY

Total Stations:		Total Stations:	
# Complete:	0	# Complete:	0
% Complete:	0.00%	% Complete:	0.00%

DAILY ACTIVITIES LOG

Time	*Description*

SUMMARY OF PROJECT TIME

Operation	*today*	*previous total*	*Total*
Mob/Demob			0
Operations			0
Standby Weather			0
Standby Other			0
Standby in Port			0
Standby Client			0
Technical Downtime			0
Vessel Downtime			0
Maintenance Time			0
TOTAL	0	0	**0**

CSA INTERNATIONAL, INC.
Daily Survey Report (*Cont'd*)

PLANNED ACTIVITY FOR NEXT 24 HOURS

ACCIDENTS/INCIDENTS

HAZARDS REPORTS

AUDITS COMPLETED

SIGHTINGS OF/INTERACTIONS WITH FISHERMEN

EMERGENCY DRILLS COMPLETED

HSE ISSUES/CONCERNS

MARINE MAMMAL/SEA TURTLE SIGHTINGS

CURRENT ESTIMATE OF COMPLETION DATE

CSA INTERNATIONAL, INC.
Daily Survey Report (*Cont'd*)

MONTHLY EVENTS

Event	*Quantity*
Number of Fatalities	
Number of Lost Time Injuries	
Number of Restricted Work Injuries	
Number of Medial Treatment Injuries	
Number of First Aid Injuries	
Number of Fires and Explosions	
Number Incidents involving Equipment Damage	
Number of Near Misses	
Number of Spills (to sea or land)	
Number of Security Incidents	
Number of hazard reports /STOP cards or safety observations	
Number of incidents involving stakeholder complaints	
Amount of waste generated, categorized by type. (monthly only)	
Amount of fuel oil / diesel used	

At the completion of the survey a report on injury absences and details of ongoing HSE Programs/Initiatives will be completed.

CSA INTERNATIONAL, INC.

Management of Change Order

Date:

To:

Subject:

Comments:

Project Change	Reason for Change

Approved by:

CSA Project Manager

____

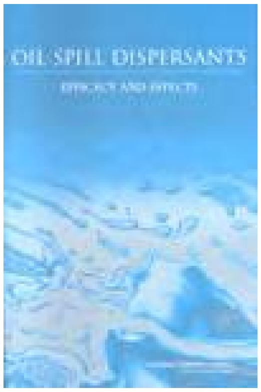
Client Representative

____

ATTACHMENTS

An Industrial Hygiene (IH) Technician equipped with air monitoring equipment including, but not limited to, an Ultrarae to sample for benzene and a Multirae to continuous sample continuously for VOCs, LEL, H2S and CO, will be aboard the vessel to monitor air quality during the effort. The IH technician will inform the boat crew and the vessel will re-position, if the air quality meets or exceeds the following:

Compound	**Threshold**
Benzene	0.5 ppm
VOCs	50 ppm
H2S	5 ppm
LEL	10%
CO	15 ppm



Understanding Oil Spill Dispersants: Efficacy and Effects

Committee on Understanding Oil Spill Dispersants: Efficacy and Effects, National Research Council

ISBN: 0-309-54793-8, 396 pages, 6 x 9, (2005)

5

Toxicological Effects of Dispersants and Dispersed Oil

One of the most difficult decisions that oil spill responders and natural resources managers face during a spill is evaluating the environmental trade-offs associated with dispersant use. The objective of dispersant use is to transfer oil from the water surface into the water column. When applied before spills reach the coastline, dispersants will potentially decrease exposure for surface dwelling organisms (e.g., seabirds) and intertidal species (e.g., mangroves, salt marshes), while increasing it for water-column (e.g., fish) and benthic species (e.g., corals, oysters). Decisions should be made regarding the impact to the ecosystem as a whole, and this often represents a trade-off among different habitats and species that will be dictated by a full range of ecological, social, and economic values associated with the potentially affected resources. Comparing the possible ecological consequences and toxicological impacts of these trade-offs is difficult. First, each oil spill represents a unique situation and second, it is often difficult to extrapolate from published research data into field predictions, especially regarding the possibility of long-term, sublethal toxicological impacts to resident species (Box 5-1 provides definitions for most the common terms used in discussions of toxicological effects).

Historically, the use of dispersants in the United States has been restricted primarily to deepwater (>10 m), offshore spills. In addition, the focus and the recommendations of the 1989 NRC report on oil dispersants were based on expected impacts of dispersants and dispersed oil during open ocean spills (NRC, 1989). As the potential use of dispersants is expanded into nearshore, estuarine, and perhaps even freshwater systems,

BOX 5-1
Common Toxicological Terms Related to Dispersant Toxicity Testing

Exposure—Contact with a chemical by swallowing, breathing, or direct contact (such as through the skin or eyes). Exposure may be either acute or chronic.

Acute—An intense event occurring over a short time, usually a few minutes or hours. An acute exposure can result in short-term or long-term health effects. An acute effect happens within a short time after exposure. Acute toxicity to aquatic organisms can be estimated from relatively short exposures (i.e., 24, 48, or 96 hr) with death as the typical endpoint.

Chronic—Occurring over a long period of time, generally several weeks, months or years. Chronic exposures occur over an extended period of time or over a significant fraction of a lifetime. Chronic toxicity to aquatic organisms can be estimated from partial life-cycle tests of relatively short duration (i.e., 7 days).

Sublethal—Below the concentration that directly causes death. Exposure to sublethal concentrations of a material may produce less obvious effects on behavior, biochemical and/or physiological function (i.e., growth and reproduction), and histology of organisms.

Delayed Effects—Effects or responses that occur some extended time after exposure.

Static Exposures—Exposures for aquatic toxicity tests in which the test organisms are exposed to the same test solution for the duration of the test (static non-renewal) or to a fresh solution of the same concentration or sample at prescribed intervals such as every 24 hr (static renewal). The concentration of the test material may change during the test due to bio-

the trade-offs become even more complex. For example, the protection of sensitive habitats, such as tropical coral reefs and mangroves, is a priority in oil spill response decisions. Many studies have shown that oil, floating above subtidal reefs, has no adverse effects on the coral; however, if allowed to reach the shoreline, the oil may have long-term impacts to a nearby mangrove system. In addition, oil may persist in the mangrove system creating a chronic source of oil pollution in the adjacent coral reefs. The trade-off would be to consider the use of dispersants. Application of

logical uptake, volatilization, adherence to the test vessel, chemical degradation, etc.

Flow-Through Exposures—Sample to be tested is pumped continuously into a dilutor system and then to the test vessels. This method is used to control sample concentration throughout the duration of the test.

Spiked Exposures—Spiked Declining (SD) Exposures: Concentration of dispersant sample is highest at start and then declines to non-detectable levels after 6–8 hr using a flow-through exposures protocol developed by Chemical Response to Oil Spills Environmental Research Forum (CROSERF) participants.

LC_p—Lethal Concentration: The toxicant concentration that would cause death in a given percent (p) of the test population. For example, the LC_{50} is the concentration that would cause death in 50 percent of the population. The lower the LC, the greater the toxicity.

EC_p—Effective Concentration: A point estimate of the toxicant concentration that would cause an observable adverse effect on a quantal ("all or nothing") response in a given percent (p) of the population.

IC_p—Inhibition Concentration: A point estimate of the toxicant concentration that would cause a given percent (p) reduction in a non-quantal biological measurement such as reproduction or growth.

NOEC—No-Observed-Effect-Concentration: The highest concentration of toxicant to which organisms are exposed in a full or partial (short-term) life-cycle test that causes no observable adverse effects on the test organisms (i.e., the highest concentration of toxicant at which the values for the observed responses are not statistically different from the control).

SOURCES: Singer et al., 1991; Rand, 1995; Grothe et al., 1996; EPA, 2002a,b, 2005; New York Department of Health, 2005.

dispersant would result in dispersion of the oil in the water column and so provide some degree of protection to the mangroves; however, the reef system would now have to endure the consequences of an increase in dispersed oil in the water column (see section on coral reefs later in this chapter). Therefore, for oil spill responders to decide upon appropriate response strategies, it is important that decisions are based on sound scientific data. Ecological factors that go into this decision include: expected sensitivity of exposed resources, proportion of the resource that would be

affected, and recovery rates (Pond et al., 2000). There is a tremendous need to reduce the uncertainty associated with each of these decision criteria.

This chapter reviews recent laboratory, mesocosm, and field studies on the toxicological effects of dispersants and dispersed oil, particularly those published since the 1989 NRC report on oil dispersants (NRC, 1989). The intention is first to summarize the current state of understanding regarding the biological effects of dispersants and dispersed oil, and second to make recommendations for additional studies that will help fill critical data gaps in the knowledge and understanding of the behavior and interaction of dispersed oil and the biotic components of ecosystems. The following discussion is limited primarily to studies of the toxicological effects on individual organisms, as opposed to populations or communities. This narrower scope reflects the current state of science in ecotoxicology (see Box 5-2). Although the research and management communities recognize the importance of considering higher order ecological effects, not enough is known to extrapolate from toxicity tests to population or community-level impacts—an issue that concerns all applications of ecotoxicology. Consequently, the explicit consideration of these impacts, and formulation of research to address them, is beyond the scope of this report on the application of ecotoxicological principles to oil spill research.

Due to implementation of several of the recommendations made in 1989 (NRC, 1989), particularly the standardization of toxicity testing methods and information garnered from long-term monitoring of field studies, some general conclusions about the toxicity of dispersants and dispersed oil can be reached. However, there are still areas of uncertainty that will take on greater importance as the use of dispersants is considered in shallow water systems. Specifically, there is insufficient understanding of the fate of dispersed oil in aquatic systems, particularly interactions with sediment particles and subsequent effects on biotic components of exposed ecosystems. In addition, the relative importance of different routes of exposure, that is, the uptake and associated toxicity of oil in the dissolved phase versus dispersed oil droplets versus particulate-associated phase, is poorly understood and not explicitly considered in exposure models. Photoenhanced toxicity has the potential to increase the impact "footprint" of dispersed oil in aquatic organisms, but has only recently received consideration in the assessment of risk associated with spilled oil. One of the widely held assumptions is that chemical dispersion of oil will dramatically reduce the impact to seabirds and aquatic mammals. However, few studies have been conducted since 1989 to validate this assumption. Finally, more work is needed to assess the long-term environmental effects of dispersed oil through monitoring and analysis of spills on which

BOX 5-2
Assessing Population and Community-Level Impacts: A Central Issue in Ecotoxicology

The decision of whether or not to use chemical dispersants in aquatic systems involves evaluation of the trade-offs between potential impacts on various natural resources. Toxicity tests are one of the primary tools that are used to predict these impacts. Much of the toxicological literature focuses on the effects of dispersed oil on individual organisms, because this is the level of biological organization that is most readily studied. Of far greater significance—and of far greater complexity as well—are the effects of dispersed oil on populations and communities of organisms. How to make meaningful predictions about toxicological effects on populations or communities is a problem that is not unique to the assessment of the impacts of an oil spill, but rather is a central question in the field of ecotoxicology. How does the loss or impairment of one or more individual organisms impact a population? How does damage to single or multiple populations impact a community? In the case of dispersed oil, numerous ecological factors may affect the impacts to, and recovery of, these higher levels of biological organization, including the proportion of the resource affected (which in turn involves an understanding of the toxicological sensitivity of organisms as well as the behavior, habits, and habitats that will affect the probability of a species being exposed to oil), birth and death rates of the affected species, the current status of the population (e.g., endangered or common species), life stages that are present, and time of year (e.g., nesting or spawning season, seasonal migration).

Population and community models are tools that show promise in enhancing our understanding of the toxicological impacts to these higher levels of biological organization. Despite recent efforts to advance these approaches (SETAC, 2003), there is no scientific consensus on this issue. Consequently, the majority of ecological risk assessments of environmental chemicals are still based on species-specific tests of toxicological effects on individual organisms. Until population and community-level approaches are more widely accepted and utilized in ecotoxicology, evaluations regarding the impacts of oil spills will remain largely based on qualitative assessments and best professional judgment. However, progress has been made in our understanding of the long-term effects of oil spills on biological communities. The NRC (2003) report on *Oil in the Sea III: Inputs, Fates and Effects* provides a good summary of some of the long-term studies that have been conducted after oil spills, especially those assessing effects on benthic communities and seabirds. For the moment, these types of studies represent the best chance of improving our understanding of the effects of spilled and dispersed oil on biological populations and communities.

SOURCE: SETAC, 2003.

dispersants have been used. Interestingly, several of these data gaps were also identified in 1989 (NRC, 1989).

TESTING PROCEDURES FOR DISPERSANT AND DISPERSED OIL TOXICITY

Toxicity Tests

Much that is currently known about the toxicity and biological effects of dispersants and dispersed oil has been derived from bench-scale acute toxicity tests. These tests typically consist of exposing a single species to varying dilutions of dispersant or dispersed oil preparations under carefully controlled laboratory conditions. Factors that influence such tests include:

- choice of test organism and life stage
- condition of oil (fresh versus weathered)
- method of preparing test solutions
- exposure conditions
- choice of response parameters

Commonly used test organisms include fish, mollusks, arthropods, annelids, and algae. The choice of test organism is dictated by a combination of factors including potential risk, comparative sensitivity, suitability of the species to the testing conditions, and relative ecological and economic significance. An additional consideration is the specific life stage to be tested, because larvae and adults may respond to exposure in significantly different ways.

The method of preparing test solutions is particularly important in the case of dispersed oil testing. Water and oil are not easily miscible, so factors such as mixing energy and loading method can readily affect the relative concentrations of oil components to which test organisms are exposed. Dispersants can also separate and form films on water unless test solutions are properly prepared and mixed.

Exposure conditions in toxicity tests for dispersants and dispersed oil vary with the choice of test chamber (e.g., open or closed), the exposure model (e.g., static or flow-through, spiked or continuous), route of exposure (e.g., water or food), test duration, and other factors such as temperature, salinity, and buffering capacity. The choice of test duration alone can significantly overestimate or underestimate toxicity depending on the actual oil spill situation being simulated.

The choice of response parameters measured in a test can be significant as well. Current generation dispersants appear to cause toxicity

through disruptive effects on membrane integrity and a generalized narcosis mechanism (NRC, 1989). Dispersed oil, on the other hand, exerts a toxic effect through multiple pathways including narcosis, more specific receptor-mediated pathways associated with elevated dissolved phase exposures, and possibly by additional pathways such as smothering by dispersed oil droplets. The presence of receptor-mediated pathways suggests that relatively short-term toxicity tests with death as the primary or sole endpoint may not be sufficient to adequately assess the potential risks of dispersed oil. Short-term tests are also incapable of addressing potential delayed effects due to metabolism of oil constituents, bioaccumulation, or possible photoenhanced toxicity.

Although much of the literature on the toxicity of dispersants and dispersed oil is based on typical static exposures of 48–96 hr duration, such tests have been criticized as potentially overestimating the toxicity of oil and dispersed oil in actual spill scenarios (NRC, 1989; George-Ares, et al., 1999). In response to these concerns, a university-industry-government working group, the Chemical Response to Oil Spills Environmental Research Forum (CROSERF), was organized to coordinate and disseminate research on oil spill dispersant use. CROSERF developed toxicity test protocols involving spiked exposures of shorter durations and standardized preparations of water accommodated fractions (WAF) of oil and chemically enhanced water accommodated fractions of dispersed oil (CEWAF) (Singer et al., 1991, 1993, 1994a,b, 1995, 2000, 2001a,b; Clark et al., 2001; Rhoton et al., 2001). For clarity, the term "CEWAF" will only be used in this chapter when referring to a dispersed oil water accommodated fraction that is prepared using the CROSERF protocols. "Chemically dispersed oil" will be used to describe non-CROSERF preparation methods. The CROSERF test methods are summarized in Table 5-1.

The main focus of CROSERF was to standardize methods (i.e., preparation and quantification of fractions and exposure protocols) to allow for greater comparability of toxicological data. In this regard, CROSERF was quite successful. Significant toxicological information was generated using these protocols that successfully addressed the relative toxicity of different dispersants and oil, as well as the relative sensitivity of test organisms.

Refinements to the CROSERF protocols may be warranted for future toxicity testing of dispersants and dispersed oil, either to address specific concerns with the current test procedures (as highlighted below) or to provide greater site-specificity for risk assessment purposes (e.g., dispersant use in nearshore areas). For example, several refinements to the CROSERF procedures have been proposed to adapt the test to subarctic conditions, including changes in WAF preparation, exposure and light regimes, analytical chemistry, and use of subarctic test organisms (Barron

TABLE 5-1 CROSERF Toxicity Test Specifications[a]

Parameter	CROSERF Procedure
WAF and CEWAF Preparation	
Water	Local seawater recommended; minimal 0.45 µm filtration
Oil	Fresh and artificially weathered[b]
Oil loading	Variable loading (0.01–25 g of oil per liter of water); serial dilution not recommended
Vessel	1–20 L carboys or aspirator bottles as appropriate for amount of solution required
Head space	20–25% by volume
Mixing energy/duration[c]	Original: 18–24 h at low mixing energy (approximately 200 rpm with no vortex) and no settling time for WAF, and moderate mixing energy (20–25% vortex) with 3–6 h settling time for CEWAF; Modified[d]: WAF and CEWAF both prepared with moderate mixing energy and settling
Mixing conditions	Sealed in dark at test temperatures
Analytical chemistry[e]	TPH and $<C_{10}$ volatile hydrocarbons required, other analyses optional; TPH, alkanes measured by GC/FID; VOCs and PAHs measured by GC/MS
Dispersant (dispersant:oil)	Primarily Corexit 9500 and/or 9527 (1:10); occasionally Corexit 9554 and others
Dispersant concentration verification	UV–spectroscopy
Test Procedures	
Test design	Five treatments plus control, each with three replicates
Test concentrations	Exposure concentrations derived from a series of geometrically progressing oil loading rates; for toxicity comparisons, total hydrocarbon content (THC: TPH plus $<C_{10}$ volatile hydrocarbons) recommended as concentration endpoint
Exposure regime	48 or 96 h tests in sealed vessels; static-renewal exposures for duration of test, aeration discouraged; flow-through "spiked exposures" with concentrations decreasing to non-detectable levels in <8 h
Test maintenance	Renew solutions at unspecified intervals for static renewal tests, removing dead organisms; dead organisms not removed in flow-through exposures; feeding as specified for test species, with food amount adjusted for loss of test organisms

TABLE 5-1 Continued

Parameter	CROSERF Procedure
Species/life stage	Temperate aquatic species/early life stages
Temperature; salinity	Temperatures appropriate to species; salinity full-strength seawater
Light regime	Laboratory lighting (fluorescent)
Toxicity endpoint	Lethality assessed daily for length of test; sublethal endpoints assessed as appropriate for test organism
Bioaccumulation	Not measured

[a]SOURCE: Singer et al. (1991); Singer et al. (2000); Clark et al. (2001), Rhoton et al. (2001), Singer et al. (2001a).
[b]Modified ASTM Method D-86 (1990 modification); oil "topped" by distillation to 200 °C roughly simulating 1 day at sea (Daling et al. 1990; Singer et al., 2001b).
[c]WAF=Water accommodated fraction; CEWAF=Chemically enhaced WAF, or chemically dispersed oil; stir bar size 1–2 in as appropriate.
[d]Clark et al. (2001) modification of standard CROSERF mixing energy protocol for physically dispersed oil (WAF) using 20–25% vortex, followed by 6 h settling time.
[e]TPH: total petroleum hydrocarbons; alkanes: >10 carbon alkanes; VOC: volatile organic compounds (<10 carbon alkanes and MAHs); PAHs: polycyclic aromatic hydrocarbons; GC: gas chromatography; FID: flame ionization detection; MS: mass spectrometry

and Ka'aihue, 2003). However, the potential benefits of altering test protocols from the CROSERF procedures should be carefully weighed against the implications for potential loss of data comparability and reproducibility.

Some factors to consider in possible refinements to the current CROSERF test protocols for future testing efforts include:

- procedures for making dilutions to be tested
- exposure regimes, including test chambers
- methods for quantifying petroleum exposure
- chemical measurements
- response parameters
- potential photoenhanced toxicity

Two alternate methods for preparing WAF and CEWAF fractions have been suggested, discussed at great length, and remain the subject of scientific debate (see Singer et al., 2000; 2001a; Barron and Ka'aihue, 2003) The CROSERF protocols recommend preparation of toxicity test solutions

by variable loading using a series of decreasing concentrations of applied oil and dispersant (Figure 5-1). Other researchers (for example see Barron and Ka'aihue, 2003) have proposed the use of a single oil:water loading rate and the preparation of test solutions using various dilutions of the stock preparation. The decision of which method to use may depend ultimately on the specific scientific question being addressed. Singer et al. (2001a) argue for the variable loading method because they believe it is more "field relevant" since spilled oil slicks tend to be dynamic, continu-

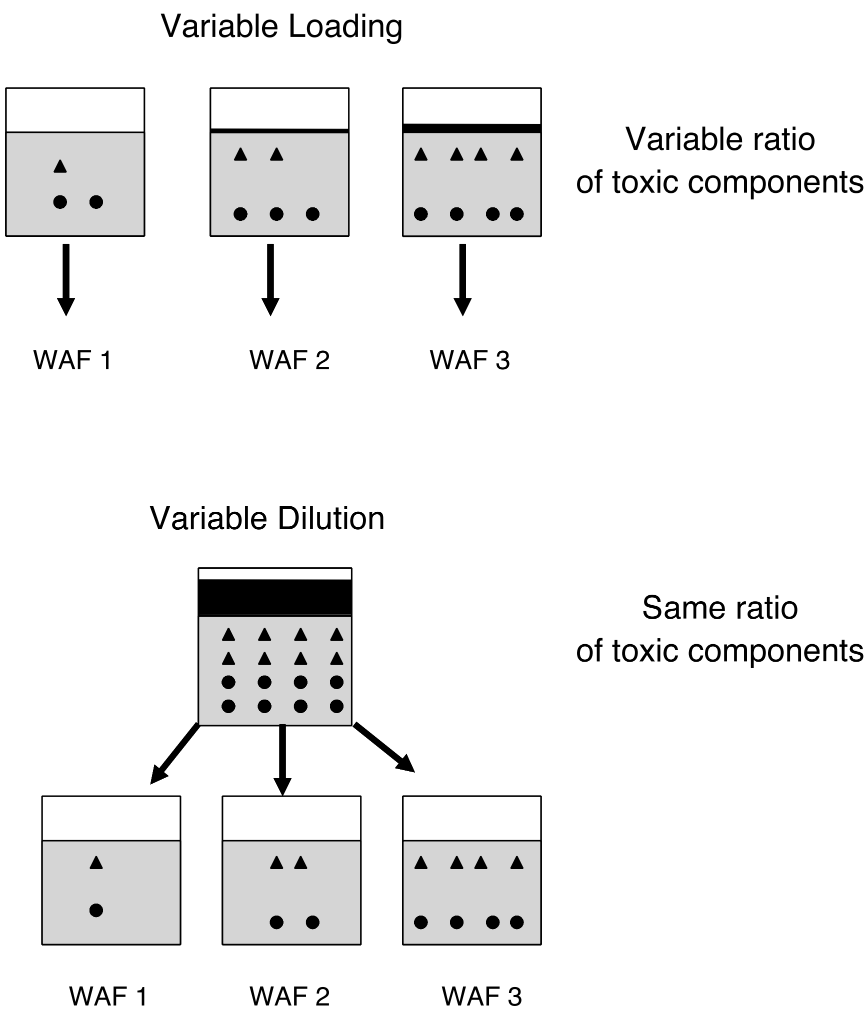


FIGURE 5-1 Comparison of variable loading and variable dilution methods of preparing toxicity test solutions.
SOURCE: Barron and Ka'aihue, 2003; courtesy of Elsevier.

ally changing in size, shape, and thickness. Consequently, these tests address the question: "At what oil to water loading ratio is WAF (CEWAF) toxic?" Barron and Ka'aihue (2003) advocate a variable dilution method for preparing a WAF for testing dispersant that standardizes the oil:water ratio and provides a consistent chemical concentration in a test-series for each oil-dispersant combination (Figure 5-1). This approach answers the question: "At what dilution is a given oil:water ratio of WAF (CEWAF) toxic?" Because it has not been conclusively demonstrated that either method more accurately simulates the temporal dilution of dispersed oil under actual spill conditions, we do not endorse one method over the other. As noted below, there are drawbacks to both approaches.

In the variable loading method, the dispersant:oil ratios do not change and, therefore, each test preparation will have different amounts of oil and dispersant relative to the volume of water in the test chamber. As a result mixing energies change as loading rate (Singer et al., 2000), potentially affecting droplet size or coalescence. The drawback of the variable dilution method has been described as the production of the equal ratio of each specific PAH across the dilution range (Barron and Ka'aihue, 2003). WAF and CEWAF produce significant proportions of oil in the droplet phase, such that increasing dilution may differentially affect the partitioning of the PAH into the aqueous phase. In addition, Barron and Ka'aihue (2003) have argued that the variable dilution approach provides economies in analytical costs by reducing the need to analyze the composition of every tested concentration. However, if chemical analyses were limited to stock solutions, inaccuracies may occur due to differential partitioning in the test dilutions, adsorption of compounds onto test chambers, or loss to the gaseous phase.

The interpretation of the results of toxicity tests can be significantly affected by the method of WAF and CEWAF preparation because of the variable solubilities of the many components in oil. For example, the variable loading method yields different mixtures of petroleum hydrocarbons at different loading rates (see Figure 5-1). The problems that arise between the two methods are due to the fact that often both methods report their data in the same form (i.e., in ppm of some overall metric, such as TPH or tPAH). Therefore, the elimination of any fractional characteristics can lead to a misunderstanding of what that concentration actually represents. For example, LC_{50} data derived from tPAH or TPH alone may result in under- or overestimation of toxicity depending on test preparation method used. Hence, more complete characterizations of chemical analytes are needed.

Another issue with the CROSERF protocols concerns the mixing energies involved in the process of preparing test solutions. The various CROSERF protocols employ equal mixing energies for the production of CEWAF, but differ in the approaches for the production of WAF. For ex-

ample, initial CROSERF protocols (e.g., Singer et al., 2000) used slow mixing (200 rpm) with no vortex for WAF and a vortex of 20–25 percent for CEWAF preparations. Additional modifications of the method were made (e.g., Clark et al., 2001) so that CEWAF and WAF were prepared using equal mixing energies and a 20–25 percent vortex. Unless a clear rationale can be provided for doing otherwise, it is recommended that equal mixing energies for both WAF and CEWAF be considered for standardization purposes.

A potential issue with the exposure regimes of the CROSERF test is the use of airtight test chambers for flow-through tests. Volatiles, although highly toxic, tend to evaporate very rapidly from spilled oil (NRC, 2003) but are retained in the CROSERF test with unweathered oil because of the sealed nature of the test chamber. The advantage of this approach is that it attempts to standardize the exposure regime, but the drawback is that it may result in an overestimation of toxicity. In most instances, the application of dispersant during an oil spill will happen at least several hours after the initiation of the spill, such that substantial weathering of spilled oil will have occurred (see modeling results in Appendix E). In order to better reflect actual exposure scenarios, open chambers could be considered for use with unweathered oil. Alternatively, tests with closed chambers could be conducted with weathered oil. The choice of experimental protocol will depend on the purpose of the experiment (e.g., standardization or site-specific assessment). Similarly, the temporal exposure regimes of the CROSERF test may not provide an appropriate simulation for some spill situations. For instance, spiked, flow-through exposures in the recommended CROSERF test protocols have oil concentrations decreasing by half about every 2 hr with nondetectable concentrations being reached at about 8 hr. This exposure regime may be a relatively accurate approximation of the exposure situation for the majority of offshore spills in temperate climes. However other temperate zone oil spills (French-McCay, 1998), especially subarctic spills (Neff and Burns, 1996; Short and Harris, 1996), may cause much longer periods of elevated PAH, compounds that contribute significantly to the toxicity of chemically and physically dispersed oil. Furthermore, future potential uses of dispersants in either semi-enclosed inshore waters or freshwater situations could conceivably result in much longer exposure durations than originally envisioned by the CROSERF working group. Thus, the CROSERF spiked protocol may reflect the typical offshore, open-water spill conditions relatively accurately, but longer test durations may yield exposure scenarios that more realistically recreate certain spill conditions. Spiked exposure data yield significantly lower toxicity values than standard constant exposure tests of longer duration (Figure 5-2; also, Clark et al., 2001; Fuller and Bonner, 2001). Consequently, the use of CROSERF spiked exposure data in risk

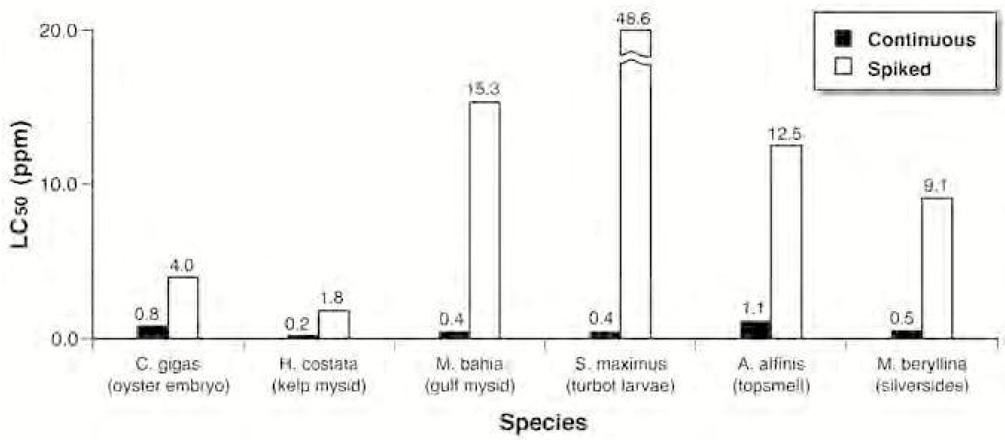


FIGURE 5-2 Comparison of the LC_{50}s for continuous versus spiked exposure regimes using chemically enhanced water accommodated fraction (CEWAF) of different oils. Continuous exposures were 96 hours in duration, except for tests with oyster larvae that were 48 hours. Spiked tests represented an 8-hour declining exposure. Species were exposed to fresh Forties crude oil and Corexit 9500, except for topsmelt, which were exposed to fresh Prudhoe Bay crude oil, and kelp mysid, which were exposed to fresh Kuwait crude oil and Corexit 9527. LC_{50}s for spiked exposures were based on the initial total petroleum hydrocarbon concentration of the CEWAF.
SOURCE: Data are from Clark et al. (2001) and Singer et al. (2001b).

assessment should be evaluated in the context of the specific spill scenarios under consideration.

Additionally, the literature calls for better exposure quantification in testing protocols, moving away from nominal doses and simple estimates of total petroleum hydrocarbon (TPH) to the measurement of specific toxicants in the exposure media, both dissolved and suspended (NRC, 1989; Singer et al., 2000; Shigenaka, 2001; Barron and Ka'aihue, 2003). The CROSERF protocol recommends the measurement of TPH and volatile organic compound (VOC) concentrations in test mixtures, as well as analysis of each PAH in some instances. In comparison with many of the previous studies that reported only nominal concentrations of petroleum products in the test mixtures, the CROSERF protocols were a major improvement. However, future studies should clearly specify at what point during the toxicity test chemical analyses were performed and explain how these measurements were used to calculate the toxicological endpoints. In addition, other methods of quantifying exposure deserve further consideration, including the potential use of toxic units to summarize the toxicity of the various active components of dispersed oil preparations (see discussion under Mode of Action). The primary impediment to

applying the toxic unit approach is that not all of the toxic components of petroleum are well-characterized. However, when this issue is better resolved, the toxic unit approach holds considerable promise for more accurately relating exposure and toxicity.

Photoenhanced toxicity is another factor that has not been adequately considered in dispersant and dispersed oil toxicity testing under either CROSERF or non-CROSERF protocols. The toxicity of oil dispersed in water has been shown in some studies to be many times higher in the presence of the ultraviolet radiation from sunlight, yet to date only a single study has examined the photoenhanced toxicity of chemically dispersed oil (Barron et al., 2004). Photoenhanced toxicity as it relates to the effects of dispersed oil is discussed later in the chapter.

Mesocosms

Laboratory experimentation, field trials, and monitoring of spills of opportunity have supplied much of what is currently known of the potential toxicological consequences of oil spills and oil spill response measures. Laboratory experiments cannot adequately address the scale or complexity of actual spills. Field studies to better simulate actual oil spill conditions are restricted by high costs, difficulties in replicating experiments, and regulatory restrictions. Mesocosm-scale tests have been proposed as a way to bridge the gap between laboratory and field studies for testing purposes (Coelho et al., 1999). However, mesocosms have been employed in only a limited number of such studies to date.

The Shoreline Environmental Research Facility (SERF; formerly Coastal Oil Spill Simulation System) in Corpus Christi, Texas discussed in Chapter 3 was used in a series of oil spill experiments to examine bioaccumulation (Coelho et al., 1999) and *in-situ* toxicological responses of various coastal organisms, including fish and various invertebrate species (Lessard et al., 1999; Bragin et al., 1999). Also, laboratory tests were used to evaluate the toxicity of test sediments from these experiments (Fuller et al., 1999). More recently, Ohwada et al. (2003) employed a small-scale mesocosm facility in Japan to examine the fate of soluble fractions of oil and measure their effect on several marine coastal microorganisms, including bacteria, viruses, and heterotrophic nano-flagellates.

The SERF tests indicate both the potential and the limitations of mesocosms in helping explain and predict the ecological effects of oil spill response measures. However, such studies are not as readily controlled as laboratory experiments nor are they as realistic as spill-of-opportunity studies. Additional mesoscale investigations of toxicological responses to oil spill response measures are therefore considered a lower priority for future funding compared to targeted laboratory experimentation and

spill-of-opportunity studies. However, if mesocosm studies are conducted for other dispersant-related purposes, consideration should be given to the addition of carefully designed studies that examine the effects of dispersants or dispersed oil on organisms or groups of organisms that cannot be readily studied in laboratory-scale tests.

DISPERSANT TOXICITY

Early dispersant formulations (prior to 1970) were essentially solvent-based degreasing agents adapted from other uses. These early dispersants proved to be highly toxic to aquatic organisms, as seen following treatment of the *Torrey Canyon* spill, resulting in an unfavorable public impression of dispersant use that persists today. Concerns about dispersant use after the *Torrey Canyon* spill were summarized in the previous NRC dispersant review as toxicity of the products themselves, and concern that effective dispersant use would make oil constituents more bioavailable enhancing their toxicity (NRC, 1989). However, the previous NRC report concluded that the acute lethal toxicity of chemically dispersed oil is primarily associated not with the current generation of dispersants but with the dispersed oil and dissolved oil constituents following dispersion (NRC, 1989). There has been little evidence in the intervening years to support a different conclusion.

Dispersants in use today are much less toxic than early generation dispersants, with acute toxicity values (measured in standard 96 h LC_{50} tests) typically in the range of approximately 190–500 mg/L (Fingas, 2002a) as compared with dispersed oil values in the typical range of 20–50 mg/L. An abundant literature exists on the toxicity of the Corexit dispersants currently approved for use in the United States (Tables 5-2 and 5-3; George-Ares and Clark, 2000). Numerous studies have found current dispersants to be significantly less toxic than oil or dispersed oil in direct comparisons (Figure 5-3; also Adams et al., 1999; Mitchell and Holdaway, 2000; Clark et al., 2001; Fingas, 2002a), although a few studies have reported greater dispersant toxicity compared with oil or dispersed oil toxicity (Gulec et al., 1997). Sensitivity to dispersants and dispersed oil can vary significantly by species and life stage. Embryonic and larval stages appear to be more sensitive than adults to both dispersants and dispersed oil (Clark et al., 2001), with LC_{50}s for both oyster and fish larvae reported to be as low as 3 mg/L for dispersant alone and about 1 mg/L for dispersed oil. However, some studies report higher larval toxicity values (i.e., lower sensitivity) for both dispersant and dispersed oil that are closer to the adult values (Coutou et al., 2001). Variable sensitivity of early life stages to dispersants could be related to species-dependent variability in egg permeability (Georges-Ares and Clark, 2000).

TABLE 5-2 Aquatic Toxicity of Corexit® 9527 (Adapted from George-Ares and Clark, 2000)

Common Name[a]	Species	Exposure[b] (h)	Endpoint[c]
Cnidarians			
Green Hydra	*Hydra viridissima*	96	LC_{50}
Green Hydra	*Hydra viridissima*	168	NOEC
Crustaceans			
Brine shrimp	*Artemia sp.*	48	LC_{50}
Brine shrimp	*Artemia salina*	48	LC_{50}
Isopod, F	*Gnorimospaeroma oregonensis*	96	LC_{50}
Amphipod, F	*Anonyx laticoxae*	96	LC_{50}
Amphipod, F	*Anonyx nugax*	96	LC_{50}
Amphipod, F	*Boeckosimus sp.*	96	LC_{50}
Amphipod, F	*Boeckosimus edwardsi*	96	LC_{50}
Amphipod, F	*Onisimus litoralis*	96	LC_{50}
Amphipod, (juvenile), F	*Gammarus oceanicus*	96	LC_{50}
Amphipod, F	*Allorchestes compressa*	96	LC_{50}
Copepod, F	*Pseudocalanus minutus*	48	LC_{50}
Copepod, F	*Pseudocalanus minutus*	96	LC_{50}
Grass shrimp, F	*Palaemonetes pugio*	96	LC_{50}
Grass shrimp, F	*Palaemonetes pugio*	96	LC_{50}
Ghost shrimp	*Palaemon serenus*	96	LC_{50}
Giant freshwater prawn (embryo-larval)	*Macrobrachium rosenbergii*	288	EC_{50} Hatching
Prawn	*Penaeus monodon*	96	LC_{50}
Shrimp	*Penaeus vannemai*	96	LC_{50}
White shrimp (postlarvae), F	*Penaeus setiferus*	96	LC_{50}
Gulf mysid	*Mysidopsis bahia*	96	LC_{50}
Gulf mysid	*Mysidopsis bahia*	48	LC_{50}
Gulf mysid	*Mysidopsis bahia*	SD	LC_{50}
Kelp forest mysid, F	*Holmesimysis costata*	96	LC_{50}
Kelp forest mysid, F	*Holmesimysis costata*	SD	LC_{50}
Kelp forest mysid, F	*Holmesimysis costata*	96	LC_{50}
Kelp forest mysid, F	*Holmesimysis costata*	SD	LC_{50}
Kelp forest mysid	*Holmesimysis costata*	96	LC_{50}
Blue crab (larvae), F	*Callinectes sapidus*	96	LC_{50}
Molluscs			
Scallop, F	*Argopecten irradians*	6	LC_{50}
Scallop, F	*Argopecten irradians*	6	LC_{50}
Scallop, F	*Argopecten irradians*	6	LC_{50}
Red abalone (embryos)	*Haliotis rufescens*	48	EC_{50}
Red abalone (embryos)	*Haliotis rufescens*	SD	EC_{50}

Effect Concentration (ppm)	References
230[f]	Mitchell and Holdaway (2000)[f]
<15[f]	Mitchell and Holdaway (2000)[f]
52–104	Wells et al. (1982)
53–84	Briceno et al. (1992)
>1000	Duval et al. (1982)
>140	Foy (1982)
97–111	Foy (1982)
>175	Foy (1982)
>80	Foy (1982)
80–160	Foy (1982)
>80	Foy (1982)
3.0	Gulec et al. (1997)[e]
8–12	Wells et al. (1982)
5–25	Wells et al. (1982)
640 (27ºC)	National Research Council (1989)
840 (17ºC)	National Research Council (1989)
49.4[f]	Gulec and Holdaway (2000)[f]
80.4	Law (1995)
35–45	Fucik et al. (1995)
35–45	Fucik et al. (1995)
11.9	Fucik et al. (1995)
29.2,[d] 19–34	Briceno et al. (1992); George-Ares et al. (1999); Exxon Biomedical Sciences (1993a); Pace and Clark (1993)
24.1–29.2[d,f]	Inchcape Testing Services (1995); Clark et al. 2001[f]
>1014[d]	Pace et al. (1995); Clark et al. (2001)[f]
2.4[d]–10.1[d]	Pace and Clark (1993); Exxon Biomedical Sciences (1993b,c); Clark et al. 2001[f]
195[d]	George-Ares and Clark (2000); Clark et al. (2001)[f]
4.3[d]–7.3[d]	Singer et al. (1990, 1991)
120[d]–163[d]	Singer et al. (1991)
15.3[d]	Coelho and Aurand (1996)
77.9–81.2	Fucik et al. (1995)
200 (20ºC)	Ordsie and Garofalo (1981)
1800 (10ºC)	Ordsie and Garofalo (1981)
2500 (2ºC)	Ordsie and Garofalo (1981)
1.6[d]–2.2[d]	Singer et al. (1990, 1991)
13.6[d]–18.1[d]	Singer et al. (1991)

continues

TABLE 5-2 Continued

Common Name[a]	Species	Exposure[b] (h)	Endpoint[c]
Clam, F	*Protothaca stamiea*	96	LC_{50}
Pacific oyster (embryos)	*Crassostrea gigas*	48	LC_{50}
Pacific oyster (embryos)	*Crassostrea gigas*	SD	LC_{50}
Marine sand snail, F	*Polinices conicus*	24	EC_{50}
Fish			
Medaka	*Oryzias latipes*	24	LC_{50}
Rainbow trout	*Oncorhynchus mykiss*	96	LC_{50}
Spot (embryos)	*Leiostomus xanthurus*	48	LC_{50}
Spot (embryo-larval), F	*Leiostomus xanthurus*	48	LC_{50}
Top smelt (larvae)	*Atherinops affinis*	96	LC_{50}
Top smelt (larvae)	*Atherinops affinis*	SD	LC_{50}
Fourhorn sculpin, F	*Myoxocephalus quadricornis*	96	LC_{50}
Mummichog	*Fundulus heteroclitus*	96	LC_{50}
Inland silverside (larvae)	*Menidia beryllina*	96	LC_{50}
Inland silverside (larvae)	*Menidia beryllina*	SD	LC_{50}
Inland silverside (embryos)	*Menidia beryllina*	96	LC_{50}
Red drum (embryo-larval), F	*Sciaenops ocellatus*	48	LC_{50}
Sheepshead minnow	*Cyprinodon variegatus*	96	LC_{50}
Atlantic menhaden (embryo-larval), F	*Brevoortia tyrannus*	48	LC_{50}
Australian bass (larvae)	*Macquaria novemaculeata*	96	LC_{50}
Seagrass			
Turtlegrass, F	*Thalassia tesudimum*	96	LC_{50}
Macroalgae			
Giant kelp (zoospores), F	*Macrocystis pyrifera*	48	NOEC
Giant kelp (zoospores), F	*Macrocystis pyrifera*	SD	NOEC
Giant kelp (zoospores), F	*Macrocystis pyrifera*	SD	IC_{50}
Brown alga	*Phyllospora comosa*	48	EC_{50}
Bacteria			
Microtox™	*Vibrio fisheri*	0.25	EC_{50}

[a]F: field collected.
[b]SD: spiked, declining exposure (107 min half-life).
[c]EC_{50}: concentrations causing effect in 50% of organisms; LC_{50}: concentration causing mortality in 50% of organisms; IC_{50}: concentration causing inhibition in 50% of organisms; NOEC: no effect concentration.
[d]Measured values.
[e]Listed as Gulec et al., 1994 in George-Ares and Clark (2000).
[f]Updated entries not provided in George-Ares and Clark (2000).

Effect Concentration (ppm)	References
ca. 100	Hartwick et al. (1982)
3.1[d]	George-Ares and Clark (2000); Clark et al. (2001)[f]
13.9[d]	George-Ares and Clark (2000); Clark et al. (2001)[f]
33.8	Gulec et al. (1997)[e]
130–150 seawater	George-Ares and Clark (2000)
400 freshwater	
96–293	Wells and Doe (1976)
61.2–62.3	Slade (1982)
27.4	Fucik et al. (1995)
25.5[d]–40.6[d]	Singer et al (1990, 1991)
59.2[d]–104[d]	Singer et al. (1991)
<40	Foy (1982)
99–124	Briceno et al. (1992)
52.3,[d] 14.6–57	Briceno et al. (1992); Fucik et al. (1995); Pace and Clark (1993); Inchcape Testing Services (1995); Exxon Biomedical Sciences (1993d); Clark et al. (2001)[f]
58.3[d]	George-Ares and Clark (2000); Clark et al. (2001)[f]
>100	Fucik et al. (1995)
52.6	Fucik et al. (1995)
74–152	Briceno et al. (1992)
42.4	Fucik et al. (1995)
14.3	Gulec and Holdaway (2000)[f]
200	Baca and Getter (1984)
1.3[d]–2.1[d]	Singer et al. (1990, 1991)
12.2[d]–16.4[d]	Singer et al. (1991)
86.6[d]–102[d]	Singer et al. (1991)
30	Burridge and Shir (1995)
4.9–12.8	George-Ares et al. (1999); Exxon Biomedical Sciences (1992)

TABLE 5-3 Aquatic Toxicity of Corexit® 9500 (adapted from George-Ares and Clark, 2000)

Common Name[a]	Species	Exposure[b] (h)	Endpoint[c]
Cnidarians			
Green Hydra	*Hydra viridissima*	96	LC_{50}
Green Hydra	*Hydra viridissima*	168	NOEC
Crustaceans			
Amphipod, F	*Allorchestes compressa*	96	LC_{50}
Brine shrimp	*Artemia salina*	48	LC_{50}
White shrimp, F	*Palaemonetes varians*	6	LC_{50}
Ghost shrimp	*Palaemon serenus*	96	LC_{50}
Gulf mysid	*Mysidopsis bahia*	48	LC_{50}
Gulf mysid	*Mysidopsis bahia*	96	LC_{50}
Gulf mysid	*Mysidopsis bahia*	SD	LC_{50}
Copepod (adult)	*Eurytemora affinis*	96	LC_{50}
Kelp forest mysid, F	*Holmesimysis costata*	SD	LC_{50}
Kelp forest mysid, F	*Holmesimysis costata*	SD	NOEC
Prawn (larval), F	*Penaeus monodon*	96	LC_{50}
Tanner crab (larvae), F	*Chionoecetes bairdi*	96	EC_{50}
Tanner crab (larvae), F	*Chionoecetes bairdi*	SD	EC_{50}
Molluscs			
Marine sand snail, F	*Polinices conicus*	24	EC_{50}
Red abalone (embryos)	*Haliotis rufescens*	48	NOEC
Red abalone (embryos)	*Haliotis rufescens*	SD	NOEC
Red abalone (embryos)	*Haliotis rufescens*	SD	LC_{50}
Fish			
Barramundi (juvenile)	*Lates calcarifer*	96	LC_{50}
Turbot (yolk-sac larvae)	*Scophthalmus maximus*	48	LC_{50}
Turbot (yolk-sac larvae)	*Scophthalmus maximus*	SD	LC_{50}
Rainbow trout	*Oncorhynchus mykiss*	96	LC_{50}
Mummichog	*Fundulus heteroclitus*	96	LC_{50}
Sheepshead minnow (larvae)	*Cyprinodon variegatus*	96	LC_{50}
Sheepshead minnow (larvae)	*Cyprinodon variegatus*	SD	LC_{50}
Mozambique tilapia	*Sarotherodon mozambicus*	96	LC_{50}
Zebra danio	*Brachydanio rerio*	24	LC_{50}
Inland silverside (larvae)	*Menidia beryllina*	96	LC_{50}
Inland silverside (larvae)	*Menidia beryllina*	SD	LC_{50}

Effect Concentration (ppm)	References
160[f]	Mitchell and Holdaway (2000)[f]
13[f]	Mitchell and Holdaway (2000)[f]
3.5	Gulec et al. (1997)[e]
21	George-Ares and Clark (2000)
8103	Beaupoil and Nedelec (1994)
83.1[f]	Gulec and Holdaway (2000)[f]
32.2	Inchcape Testing Services (1995)
31.4[d,f]–35.9[d]	George-Ares and Clark (2000); Fuller and Bonner (2001)[f]; Clark et al. (2001)[f]; Rhoton et al. (2001)[f]
500[d,f]–1305,[d,f] >789[d,f]	Coehlo and Aurand (1997); Fuller and Bonner (2001)[f]; Clark et al. (2001)[f]; Rhoton et al. (2001)[f]
5.2[d]	Wright and Coehlo (1996)
158[d]–245[d]	Singer et al (1996)
41.4[d]–142[d]	Singer et al. (1996)
48	Marine and Freshwater Resources Institute (1998)
5.6[d,f]	Rhoton et al. (2001)[f]
355[d,f]	Rhoton et al. (2001)[f]
42.3	Gulec et al. (1997)[e]
0.7[d]	Aquatic Testing Laboratories (1994)
5.7[d]–9.7[d]	Singer et al. (1996)
12.8[d]–19.7[d]	Singer et al. (1996)
143	Marine and Freshwater Resources Institute (1998)
74.7[d]	George-Ares and Clark (2000); Clark et al. (2001)[f]
>1055[d]	George-Ares and Clark (2000); Clark et al. (2001)[f]
354	George-Ares and Clark (2000)
140	George-Ares and Clark (2000)
170–193[d,f]	Fuller and Bonner (2001)[f]
593–750[d,f]	Fuller and Bonner (2001)[f]
150	George-Ares and Clark (2000)
>400	George-Ares and Clark (2000)
25.2–85.4[d,f]	Inchcape Testing Services (1995); Fuller and Bonner (2001)[f]; Rhoton et al., 2001[f]
40.7[d,f]–116.6,[d,f] 205[d,f]	Fuller and Bonner (2001)[f]; Rhoton et al. (2001)[f]

continues

TABLE 5-3 Continued

Common Name[a]	Species	Exposure[b] (h)	Endpoint[c]
Hardy heads (juvenile), F	*Atherinosoma microstoma*	96	LC_{50}
Australian bass (larvae)	*Macquaria novemaculeata*	96	LC_{50}
Algae			
Diatom	*Skeletonema costatum*	72	EC_{50}
Brown alga (zygotes), F	*Phyllospora comosa*	48	EC_{50}
Bacteria			
Microtox™	*Vibrio fisheri*	0.25	EC_{50}

[a]F: field collected.
[b]SD: spiked, declining exposure (107 min half-life).
[c]EC_{50}: concentrations causing effect in 50% of test organisms; LC_{50}: concentration causing mortality in 50% of test organisms; NOEC: no effect concentration.
[d]Measured values.
[e]Listed as Gulec et al 1994 in George-Ares and Clark (2000).
[f]Updated entries not provided in George-Ares and Clark (2000).

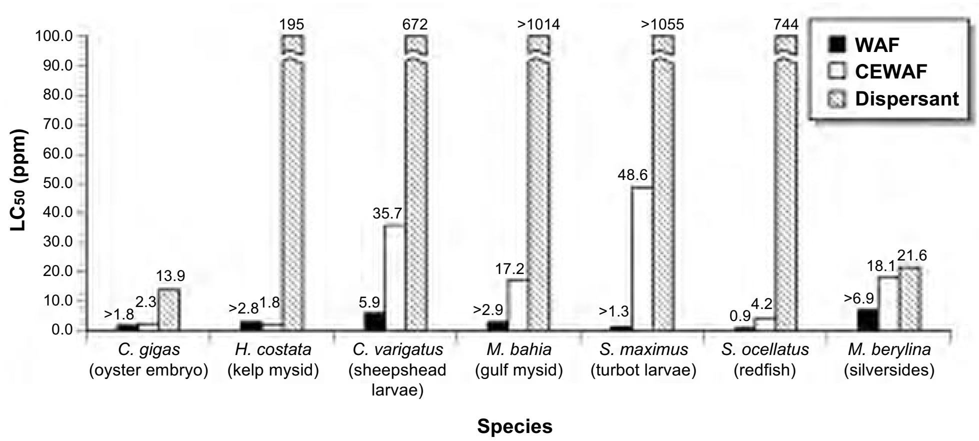


FIGURE 5-3 Comparison of the LC_{50}s derived from spiked exposures of water accommodated fractions (WAF), chemically enhanced water accommodated fraction (CEWAF), and dispersants using either fresh crude oil (Kuwait, Forties, Prudhoe Bay, and Venezuela), weathered-crude oil (Arabian medium) or fresh Medium Fuel Oil, and Corexit 9500 or Corexit 9527. LC_{50}s were based on initial concentrations of total petroleum hydrocarbons.
SOURCE: Data are from Clark et al. (2001); Fuller and Bonner (2001); and Wetzel and Van Fleet (2001).

Effect Concentration (ppm)	References
50	Marine and Freshwater Resources Institute (1998)
19.8	Gulec and Holdaway (2000)[f]
20	Norwegian Institute for Water Research (1994)
0.7	Burridge and Shir (1995)
104[d,f]–242[d,f]	Fuller and Bonner (2001)[f]

In addition to acute toxicity, dispersants may have more subtle effects that influence organism health. Dispersant has been reported to significantly affect the uptake, but not necessarily bioaccumulation, of oil constituents (Wolfe et al., 1998a,b,c; 1999a,b; 2001). In addition, dispersants have been reported to have toxic effects on microbial processes that could potentially interfere with oil decomposition (Varadaraj et al., 1995), but this effect may be offset by other factors that appear to promote oil biodegradation (Swannell and Daniel, 1999). For further discussion on the effect of dispersants and dispersed oil on microbial processes, see section on Microbial Communities (found later in this chapter) and Chapter 4.

TOXICITY OF DISPERSED OIL

Oils are a complex mixture of literally thousands of compounds of varying volatility, water solubility, and toxicity. The purpose of chemical dispersants is to facilitate the movement of oil into the water column. The result is a complex, multi-phase mixture composed of dissolved dispersant, dissolved petroleum hydrocarbons, oil/dispersant droplets, and bulk, undispersed oil. Consequently, aquatic organisms are potentially exposed to many toxicants with different modes of action and through different

routes of exposure. Toxicity of dispersed oil in the environment will depend on many factors, including the effectiveness of the dispersion, mixing energy, type of oil, the degree of weathering, type of dispersant, temperature, salinity, duration of exposure, and degree of light penetration into the water column. There is a wealth of information on the biological effects, particularly acute toxicity, associated with exposure to different types of oil (summarized in NRC, 2003). Rather than review these findings, the purpose here is to focus on the issues that are pertinent to understanding the bioavailability and toxicity of chemically dispersed oil.

Route of Exposure

Acute toxicity of oil is the result of a number of interacting chemical, physical, and physiological factors. Thus, toxicity is highly dependent on the conditions of constantly changing exposure. Adverse effects resulting from dispersed oil can be a result of: (1) dissolved materials (e.g., aromatic petroleum hydrocarbons, or dispersant), (2) physical effects due to contact with oil droplets, (3) enhanced uptake of petroleum hydrocarbons through oil/organism interactions, or (4) a combination of these factors (Singer et al., 1998). In general, bioavailability and toxicity of individual hydrocarbons are related to their solubility in water because dissolved hydrocarbons diffuse across the gills, skin, and other exposed membranes of aquatic organisms. The compounds of most concern are the low-molecular-weight alkanes and monocyclic, polycyclic, and heterocyclic aromatic hydrocarbons (Lewis and Aurand, 1997). The monocyclic aromatic hydrocarbons (e.g., benzene, toluene, ethylbenzenes, and xylenes) and low-molecular-weight alkanes are soluble and toxic to aquatic organisms, but these compounds are also very volatile, typically vaporizing rapidly (see Figures 4-2, 4-5, and 4-6 in Chapter 4). As the oil weathers, the concentrations of PAH in the oil plume (including the parent compounds and alkyl substituted homologues) will become relatively enriched compared to the low-molecular-weight alkanes and monocyclic aromatics contributing more to the longer-term toxicity of oil. Because substantial weathering of oil may occur before dispersant is applied (typically at least several hours after the spill), the consequent enrichment of PAH may be particularly important for evaluating the potential toxicity of dispersed oil. Although PAH may drive the toxicity of oil in many instances, some studies have found stronger relationships between TPH concentrations and toxicity than between PAH and toxicity. For example, Barron et al. (1999) conducted studies on the effects of WAF from three different weathered oils on the mysid shrimp, *Mysidopsis bahia*. The median lethal concentrations for the three oils were within a factor of two when expressed as TPH (range from 0.88 to 1.5 mg/L TPH), but differed by nearly a factor

of five when expressed as total PAH (range from 2.2 to 9.2 µ/L). Similarly, Clark et al. (2001) found a significant association with TPH, but not PAH or volatiles, in experiments comparing the toxicity of dispersed and untreated oil to early life stages of several marine organisms. McGrath et al. (2003) evaluated the toxicity of various types of gasoline in WAF preparations using an alga, a fish, and a daphnid, and found that both aromatic and aliphatic hydrocarbons contributed to toxicity, with the relative importance of the fractions dependent on the type of gasoline. Furthermore, other components of oil, for example the heterocyclic aromatics, also may be contributing to toxicity (Barron et al., 1999). Some of these fractions are not typically measured in laboratory or field studies, but may be toxicologically important depending on the type of oil and amount of weathering. Another confounding factor in determining the cause of toxicity is that chemical analyses typically measure concentrations in whole samples that include hydrocarbons in the dissolved, colloidal, and particulate phases while the bioavailability of these phases may differ (Fuller et al., 1999). As highlighted below, distinguishing among these phases is important for understanding the fate and effects of dispersed oil.

Oil droplets can physically affect exposed organisms, for example by smothering through the physical coating of gills and other body surfaces. For some organisms, dispersed oil droplets may also be an important route of exposure to petroleum hydrocarbons, through either oil droplet/gill interactions or ingestion of oil droplets. Ramachandran et al. (2004) exposed juvenile rainbow trout to chemically dispersed oil and WAF using Corexit 9500 and Mesa crude oil and then used epifluorescence[1] to microscopically observe PAH uptake in the fish gills. Uptake of PAH from WAF was manifested as an even background of fluorescence on the fish gill with occasional bright spots. Gills of fish exposed to chemically dispersed oil showed localized focal fluorescence (i.e., bright spots), suggesting oil droplets on the gill surface. The authors hypothesized that oil droplets on the fish gill could facilitate uptake of dissolved hydrocarbons.

If dispersion is effective, oil droplets generally range in size from <3 to 80 µm (Franklin and Lloyd, 1986; Lunel, 1993, 1995b). The particle-size distribution of dispersed oil overlaps with the preferred size range of food ingested by many suspension-feeding organisms. For example, common zooplankton, such as copepods, feed on particles in the range of 5 to 60 µm, often switching their preferred particle size depending on the size distribution of available particles (Valiela, 1984). Similarly, benthic and

[1]Method of fluorescence microscopy in which the excitatory light is transmitted through the objective onto the specimen rather than through the specimen; only reflected excitatory light needs to be filtered out rather than transmitted light, which would be of much higher intensity.

epibenthic suspension feeders such as oysters, amphipods, and polychaetes are also known to select particles in size ranges that overlap with dispersed oil droplets, similar to the sizes of some common phytoplankton cells such as *Isochrysis galbana* (4–8 μm), *Chaetocerus spp*. (15–17 μm), and *Skeletonema spp*. (20–25 μm).

The importance of PAH uptake via ingestion of particulate-bound PAH is well known (e.g., Menon and Menon, 1999; Lee, 1992). For example, during the *New Carissa* oil spill near Coos Bay, Oregon, Payne and Driskell (2003) collected dissolved and oil droplet/suspended particulate material (SPM) phase water samples of physically dispersed oil and compared the PAH profiles with those of tissue samples from mussels (a suspension feeder) and Dungeness crabs (an omnivore). The results suggested that mussels accumulated PAH from both the dissolved and the oil droplet/SPM phases, with the latter predominating, while crabs accumulated PAH primarily from the dissolved phase (Figure 5-4). In addition, body burdens of mussels were approximately 500 times greater than those of crabs, indicating the relative importance of these routes of exposure.

Estimating the relative contribution of oil droplets versus particulate-bound oil to total oil exposure is problematic due to the difficulty in distinguishing uptake of these two phases. For physically dispersed oil, interactions with SPM can be very important in the ultimate fate and transport of bulk oil through the formation of oil/SPM agglomerates (see discussion in Chapter 4). Although a limited amount of work has been conducted on the interactions between chemically dispersed oil and SPM, more data are clearly needed to better understand and model the fate and effects of dispersed oil, particularly in shallow water systems with high suspended solids. The limited information available suggests that fairly high oil and SPM concentrations are required before chemically dispersed oil interacts with SPM, and that chemically dispersed oil has a much lower tendency to form SPM agglomerates compared to physically dispersed oil.

Aquatic organisms may also be exposed to oil due to contamination of their food. Wolfe et al. (1998a) evaluated the bioavailability and trophic transfer of PAH from dispersed (Corexit 9527) and untreated Prudhoe Bay crude oil in a simple marine food chain: from phytoplankton, *Isochrysis galbana*, to a rotifer, *Branhionus plicatilis*. Using [^{14}C] naphthalene as a model PAH, direct aqueous exposure was compared to dietary exposure by allowing the rotifers to feed on algae that had been pre-exposed to either WAF or chemically dispersed oil. Results indicated that approximately 20 to 45 percent of uptake was due to dietary exposure, but there was no difference in uptake via the diet between WAF and chemically dispersed oil. Information related to trophic transfer of contaminants is relevant to evaluating the risk of oil exposure, because models based solely on dissolved concentrations may substantially underestimate exposure.

In general, there is insufficient understanding of the fate of dispersed oil in aquatic systems, including interactions with sediment particles and biotic components of ecosystems. In order to better understand the fate and effects of dispersed oil, studies should be conducted to estimate the relative contribution to toxicity of dissolved-, colloidal-, and particulate-phase oil (including an evaluation of oil droplets versus oil/SPM agglomerates) in representative species. Chemical characterization should accompany these tests, including analysis of dissolved and particulate oil concentrations and bioaccumulation. The ability of decisionmakers to estimate the impacts of dispersants on aquatic organisms would be enhanced through greater understanding of these variables used in decision-making tools such as fate and effects models and risk rankings.

Mode of Action

Many oil constituents, most notably the PAH and monoaromatics, are Type I narcotics (DiToro et al., 2000). Narcosis is defined as a reversible state of arrested activity of protoplasmic structures (Bradbury et al., 1989) and is thought to be the primary mechanism of acute toxicity of oil. Often the terms “narcotic” and “anesthetic” are used interchangeably. Type I narcotics are non-polar organic chemicals with a similar mode of action, i.e., narcosis, such that toxicological effects are additive. On the other hand, Type II narcotics, also called polar narcotics, have a different mode of action than the Type I narcotics, and tend to be more toxic. Examples of polar narcotics include nitrogen heterocycles (DiToro et al., 2000). Hence, in oil the heterocyclic aromatics may act as Type II narcotics.

Regardless of their Type I or Type II classification, all organic chemicals in a field mixture contribute to toxicity by narcosis (Deneer et al., 1988); therefore, mixtures of organic chemicals, such as found during an oil spill, would be expected to exhibit additive toxicity over a range of composition ratios (van Wezel et al., 1996). Toxic unit models have been applied to estimate the acute toxicity of PAH and other oil components (Swartz et al., 1995; DiToro et al., 2000; French-McCay, 2002). A toxic unit is the ratio of the measured concentration of a chemical and the corresponding effective concentration in the same medium. Assuming toxicity is additive, the toxic unit value for individual constituents can be summed to estimate acute toxicity of the mixture. DiToro et al. (2000) and French-McCay (2002) incorporated the critical body residue (i.e., lethal body burden) concept into the narcosis toxic unit model. The assumption for this toxicological model, known as the narcosis target lipid model (McGrath et al., 2004), is that mortality occurs when the concentration of narcotic chemicals in the target lipid reaches a threshold concentration. The acute toxicity threshold is assumed to be species specific.

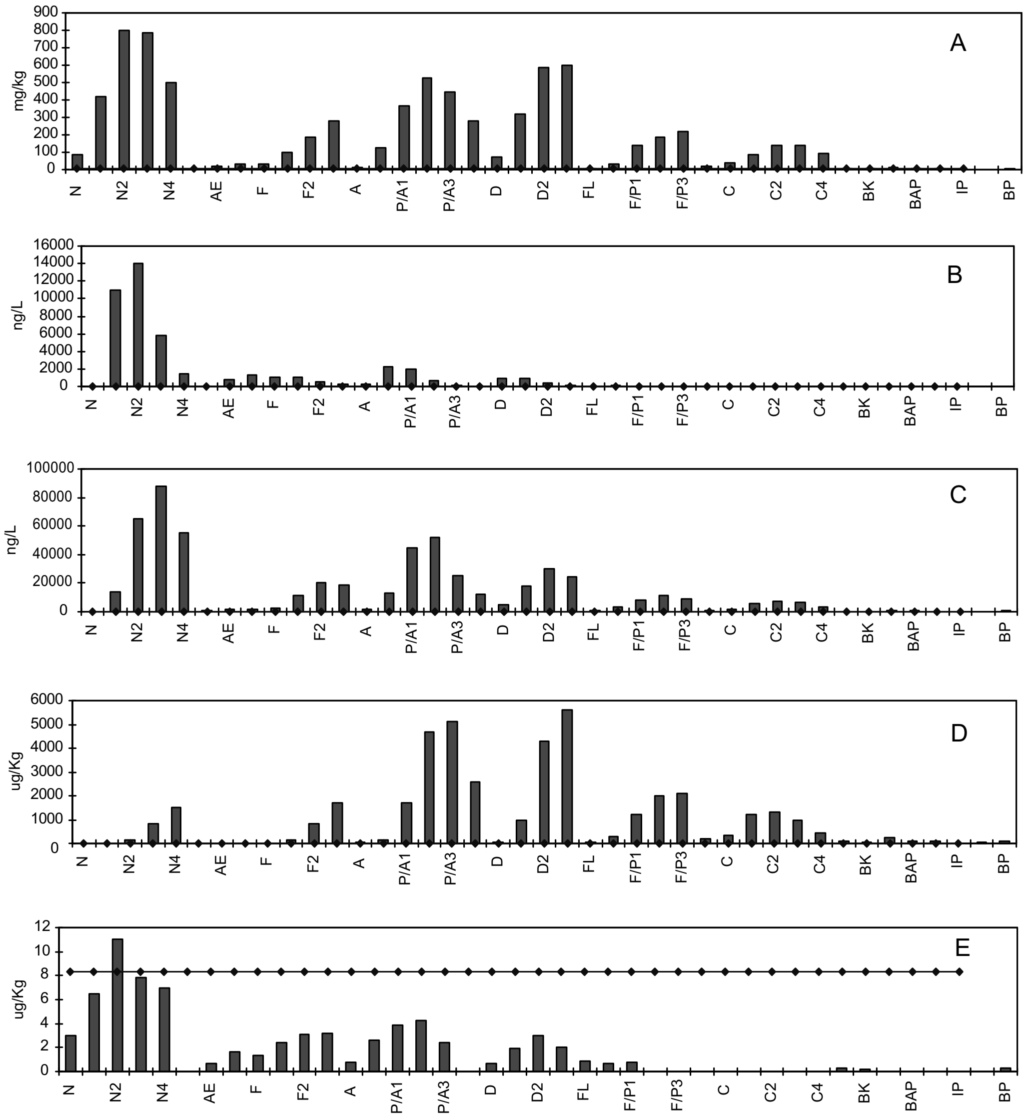


FIGURE 5-4 PAH histograms for: (A) mixed M/V *New Carissa* source oil "blend" (ET-2) collected from the beach adjacent to the vessel on 2/11/99; (B) dissolved- and (C) oil droplet-phase samples collected in the surf zone with the portable large volume water sampling system (PLVWSS) on 2/12/99; (D) mussels collected from the outside north jetty entrance to Coos Bay on 2/14/99; and (E) Dungeness crab collected inside Coos Bay midway up the main channel on 2/19/99. The diamonds connected by the horizontal line represent the sample-specific method detection limits. Note: Also provided is a complete list of analytes and abbreviations, in order, presented in Figure 5-4.

continued

Analytes	**Abbreviation**
Naphthalene	N
C1-Naphthalenes	N1
C2-Naphthalenes	N2
C3-Naphthalenes	N3
C4-Naphthalenes	N4
Biphenyl	BI
Acenaphthylene	AC
Acenaphthene	AE
Fluorene	F
C1-Fluorenes	F1
C2-Fluorenes	F2
C3-Fluorenes	F3
Anthracene	A
Phenanthrene	P
C1-Phenanthrene/Anthracenes	P/A1
C2-Phenanthrene/Anthracenes	P/A2
C3-Phenanthrene/Anthracenes	P/A3
C4-Phenanthrene/Anthracenes	P/A4
Dibenzothiophene	D
C1-Dibenzothiophenes	D1
C2-Dibenzothiophenes	D2
C3-Dibenzothiophenes	D3
Fluoranthene	FL
Pyrene	PYR
C1-Fluoranthene/Pyrenes	F/P1
C2-Fluoranthene/Pyrenes	F/P2
C3-Fluoranthene/Pyrenes	F/P3
Benzo(a)Anthracene	BA
Chrysene	C
C1-Chrysenes	C1
C2-Chrysenes	C2
C3-Chrysenes	C3
C4-Chrysenes	C4
Benzo(b)fluoranthene	BB
Benzo(k)fluoranthene	BK
Benzo(e)pyrene	BEP
Benzo(a)pyrene	BAP
Perylene	PER
Indeno(1,2,3-cd)pyrene	IP
Dibenzo(a,h)anthracene	DA
Benzo(g,h,i)perylene	BP

SOURCE: Data from Payne and Driskell, 2003; courtesy of the American Petroleum Institute.

The accuracy of toxic unit models is typically based on three assumptions: (1) all the constituents contributing to toxicity are known and measured; (2) effects concentrations of the constituents are known; and (3) chemical equilibrium exists between the organism and the exposure media (but see French-McCay, 2002). Clearly, under dispersed oil scenarios, whether in the laboratory or the field, these assumptions are not apt to be met. Nonetheless, the narcosis model may provide a better estimate of the potential acute effects of oil or dispersed oil than existing measures that rely on determining relationships between toxicity and mixtures of total volatiles, PAH, and/or TPH.

One advantage of the narcosis target lipid model is that it can and has been incorporated into oil fate models to allow estimation of toxicity to aquatic organisms (e.g., French-McCay, 2002, 2004; McGrath et al., 2003). For example, French-McCay (2002) developed an oil toxicity and exposure model, OilToxEx, as a submodel of the Spill Impact Model Application Program (SIMAP). In this model, oil toxicity is predicted by applying the narcosis target lipid model to the predicted concentrations of dissolved aromatic constituents of spilled oil. In a wide range of laboratory exposures with WAF, French-McCay (2002) found good agreement between the narcosis target lipid model predicted LC_{50}s and measured LC_{50}s. McGrath et al. (2003) used the narcosis target lipid model to estimate laboratory toxicity of different gasoline blends. Their model estimated the fate and effects of "hydrocarbon blocks," rather than tracking individual hydrocarbon components (e.g., individual aromatics). The hydrocarbon blocks represented pseudo-components with similar physical chemical properties (usually boiling point as reflected by distillate cut ranges; see Chapter 4). Their analysis indicated that reliable toxicity predictions could be achieved by modeling the fate and toxicity of the hydrocarbon blocks. The utility of this approach is being further explored to predict the fate and effects of spilled oil by incorporation into current models (e.g., GNU Network Object Model Environment) for use in pre-spill planning as well as real-time spill modeling. Nevertheless, more work needs to be done to link the additive compound-specific toxicity data with the component concentrations and mixtures within each hydrocarbon block or pseudo-component.

It should be noted that narcosis may not account for all the toxic effects due to exposure to oil or dispersed oil, particularly sublethal or long-term effects. Barron et al. (2004) evaluated the ability of four mechanism-based toxicity models, including narcosis, to predict chronic toxicity of oil to early life stage fish. They found that the narcosis model underpredicted the observed toxicity and appeared to be mechanistically inconsistent with many of the observed effects of early life stage toxicity in PAH-exposed embryos, including edema, deformities, and cardiovascular dysfunction.

Hence, in these chronic (16 to 35 days) exposures, narcosis appeared not to be the primary mode of action. In conclusion, narcosis models have utility in predicting acute mortality due to exposure to dispersed oil, but may underestimate toxicity in cases where petroleum compounds with non-narcotic modes of action are important components (e.g., alkyl phenanthrenes, heterocyclic aromatics) and where sublethal or delayed effects are manifested (Barron et al., 1999, 2004).

Photoenhanced Toxicity

A number of laboratory studies have indicated that toxicity due to PAH increases significantly (from 12 to 50,000 times) in exposures conducted under ultraviolet light, compared to exposures under the more typical conditions of fluorescent lights (e.g., Landrum et al., 1987; Ankley et al., 1994; Boese et al., 1997; Pelletier et al., 1997). This phenomenon, known as photoenhanced toxicity or phototoxicity, occurs through two mechanisms: photomodification and photosensitization (Neff, 2002; Figure 5-5). Both mechanisms result from the absorption of ultraviolet (UV) radiation by the conjugated double bonds of PAH, exciting them to the triplet state. With photomodification, the excited PAH molecule leads to the formation of highly reactive free radicals that oxidize to form products that are often more toxic than the parent PAH. As described earlier in Chapter 4, photomodification of PAH produces a wide variety of oxygenated products, including quinones, peroxides, and ketones, all of which are more water soluble than the parent PAH (Neff, 2002). Photosensitization occurs when the excited PAH transfers the energy to dissolved oxygen, forming reactive oxygen species. Because of the short-half life of these photoproducts in water, these reactions are only important when products bioaccumulate in the tissues of aquatic organisms (Newsted and Giesy, 1987) and attack cell membranes, bind DNA, or generate secondary radicals. Hence, photosensitization, the primary mechanism of photoenhanced toxicity, causes impacts that differ from the narcosis effects typically associated with PAH toxicity.

Photoenhanced toxicity has only recently received consideration in the assessment of risk associated with spilled oil (Pelletier et al., 1997; Ho et al., 1999; Barron and Ka'aihue, 2001; Duesterloh et al., 2002; Barron et al., 2004). This phenomenon has the potential to increase toxicity under spill scenarios where the opportunity for UV exposure is greatest, e.g., oil stranded on the shoreline, in a surface slick, or in shallow water. Because dispersants generally increase the water-column concentrations of dissolved and particulate petroleum hydrocarbons (including the photoactive compounds) relative to undispersed oil, photoenhanced toxicity of some PAH is an important consideration for evaluating toxicity associ-

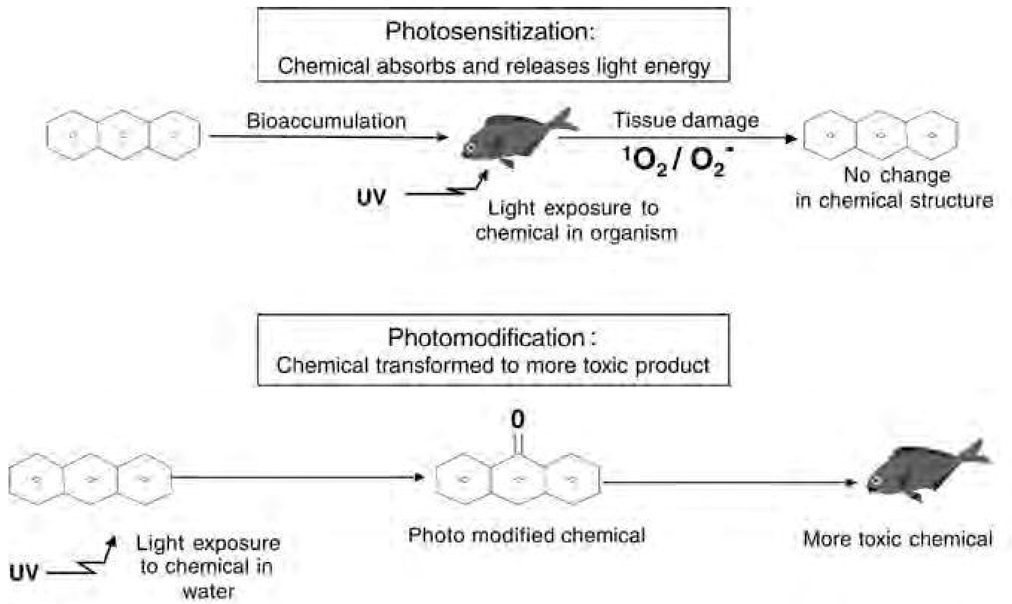


FIGURE 5-5 Mechanisms of photoenhanced toxicity.
SOURCE: Barron, 2000; courtesy of the Prince William Sound Regional Citizen's Advisory Council.

ated with water-column exposure to dispersed oil (Barron and Ka'aihue, 2001; Barron et al., 2004). Photoenhanced toxicity also has implications for the toxicological testing of spilled and dispersed oil. For example, Duesterloh et al. (2002) found that the toxicity of weathered Alaska North Slope crude oil for two calanoid copepod species was dramatically increased upon exposure of the copepods to natural sunlight. In this experiment, *Calanus marhallae* and *Metridia okhotensis* were exposed for 24 hr to low levels of oil in seawater and then exposed to different levels of natural sunlight for 3.8 to 8.2 hr. Toxicity to the copepods increased by up to 80 percent after exposure to UV in sunlight. Similarly, Pelletier et al. (1997) investigated phototoxicity in larvae and juveniles of the bivalve, *Mulinia lateralis*, and juvenile mysid shrimp, *Mysidopsis bahia*, exposed to WAF of several different petroleum products (No. 2 fuel oil, Arabian Light crude, Prudhoe Bay crude, No. 6 fuel oil). Large increases in toxicity (from 2 to 100-fold) in UV light exposures were seen in tests with Arabian Light crude, Prudhoe Bay crude, and No. 6 fuel oil, with the predominant increases found in heavier crudes corresponding to increases in the amount of higher-molecular-weight phototoxic PAH. In contrast, No. 2 fuel oil was highly toxic under both fluorescent and UV light. Finally, Barron et al. (2004) investigated the photoenhanced toxicity of weathered Alaska North Slope crude with and without dispersant (Corexit 9527) to eggs and larvae

of the Pacific herring, *Clupea pallasi*. Brief exposure to sunlight (~ 2.5 hr per day for 2 days) increased toxicity from 1.5 to 48-fold over control lighting. In addition, the toxicity of chemically dispersed oil was similar to oil alone in the control treatment, but was significantly more toxic than oil alone in the treatments exposed to sunlight. Accumulation of even small amounts of PAH may make translucent organisms susceptible to toxicological effects if these animals are subsequently exposed to sunlight in the upper part of the water column. Organisms most susceptible to photoenhanced toxicity include translucent pelagic larvae and epibenthic or benthic organisms living in shallow water areas. This phenomenon may not be important for organisms that are opaque (e.g., adult fish, crabs) or avoid sunlight through vertical migration below the photic zone (Valiela, 1984).

Current dispersed oil testing protocols do not typically include exposure to natural sunlight as a factor in evaluating toxicity; thus they may underestimate toxicity for some species, and hence underestimate the "footprint" of toxicological effects on aquatic organisms in the field. Additional toxicological studies are needed to incorporate phototoxicity into effects models, including the identification of phototoxic compounds. Models can be used to overlay this information with expected species distribution in the water column to estimate potential impacts.

Toxicity of Chemically Versus Physically Dispersed Oil

A review of the recent literature (since the publication of the 1989 NRC report on oil dispersants) reveals no consensus in the evaluation of the relative toxicities of chemically dispersed and physically dispersed oil (Clark et al., 2001; Singer et al., 1998; Fingas, 2002a; Fucik et al,. 1994). Some of the inconsistency can be attributed to studies that have drawn conclusions about relative toxicity based on comparing nominal loading rates of oil and dispersant, not on measured concentrations of dissolved hydrocarbons (e.g., Epstein et al., 2000; Adams et al., 1999; Bhattacharyya et al., 2003; Gulec et al., 1997). Loading rate data are useful for comparing the toxicity of different oils when dispersed, different dispersants with the same oil, or sensitivity comparisons among species. However, this approach has limited utility in evaluating the relative toxicity of chemically dispersed versus untreated oil based on exposure to oil in the water column. The degree to which a dispersant facilitates dissolution of petroleum hydrocarbons into the water column will influence the resulting degree of toxicity observed. Many studies have found that the concentrations of PAH are higher in the chemically dispersed oil than in WAF for equal loading of oil. This is likely due to partitioning kinetics between the dispersed oil droplets and water. That is, the increased number of oil droplets and smaller droplet diameters increase the surface area to volume

ratio such that more of the hydrocarbon components enter the dissolved phase. Consequently, it is essential to measure actual exposure concentrations to evaluate whether the bioavailability and toxicity of dispersed oil is greater than what would be expected based on the amount of oil in the water column.

Clark et al. (2001) tested three types of crude oil (Kuwait, weathered Kuwait, and Forties) and two dispersants (Corexit 9500 and 9527) in continuous and short-term spiked exposures using the early life stages of several marine species. They found that physically dispersed oil appears less toxic than chemically dispersed oil when LC_{50} is expressed as the nominal loading concentration (Figure 5-6), but when effects are based on the amount of oil measured in water (i.e., TPH), dose-response relationships are similar between chemically and physically dispersed oil.

Similarly, Ramachandran et al. (2004) measured induction of CYP1A (the liver enzyme ethoxyresorufin-*O*-deethylase or EROD) in rainbow trout to WAF and chemically dispersed oil (using Corexit 9500) made from three types of crude oil. They found that EROD activity was as much as 1,100 times higher in chemically dispersed oil treatments compared to WAF when results were expressed on percent (v/v) basis; however, when expressed as measured PAH concentrations, there was little difference between the EC_{50} values for EROD activity.

In contrast, Singer et al. (1998) concluded that the relative toxicity of CEWAF versus WAF was dependent on the test species, exposure time, and endpoint evaluated. In a series of tests, they evaluated the acute effects of untreated and dispersant-treated (Corexit 9527) Prudhoe Bay crude oil on early life stages of three Pacific marine species: red abalone, *Haliotis rufescens*, kelp forest mysid shrimp, *Holmesimysis costata*, and topsmelt, *Atherinops affinis*. Experiments were conducted using CROSERF spiked exposure protocols, including standard preparation of WAF and CEWAF. In addition to the standard toxicity test endpoints, Singer et al. (1998) evaluated initial narcosis in the exposures with *H. costata* and *A. affinis* by making behavioral observations during the first 6–7 hr of exposure and tallying the number of inactive and active animals. Narcosis was defined as those animals initially affected, but that recovered to an active state later in the exposure. Results are summarized in Table 5-4 (taken from Singer et al., 1998) and expressed as EC_{50} or LC_{50} values based on total hydrocarbon content ($THC_{(C7\text{-}C30)}$) measured at the beginning of the exposures. In tests with *H. rufescens* and *H. costata*, significant effects were seen in the CEWAF exposures at total hydrocarbon concentrations (THC) two to three times lower than in WAF tests (Table 5-4). In contrast, effects on mortality of the topsmelt, *A. affinis*, and initial narcosis were more severe in WAF exposures. Singer et al. (1998) suggest that a likely explanation for these results is compositional differences in dissolved petro-

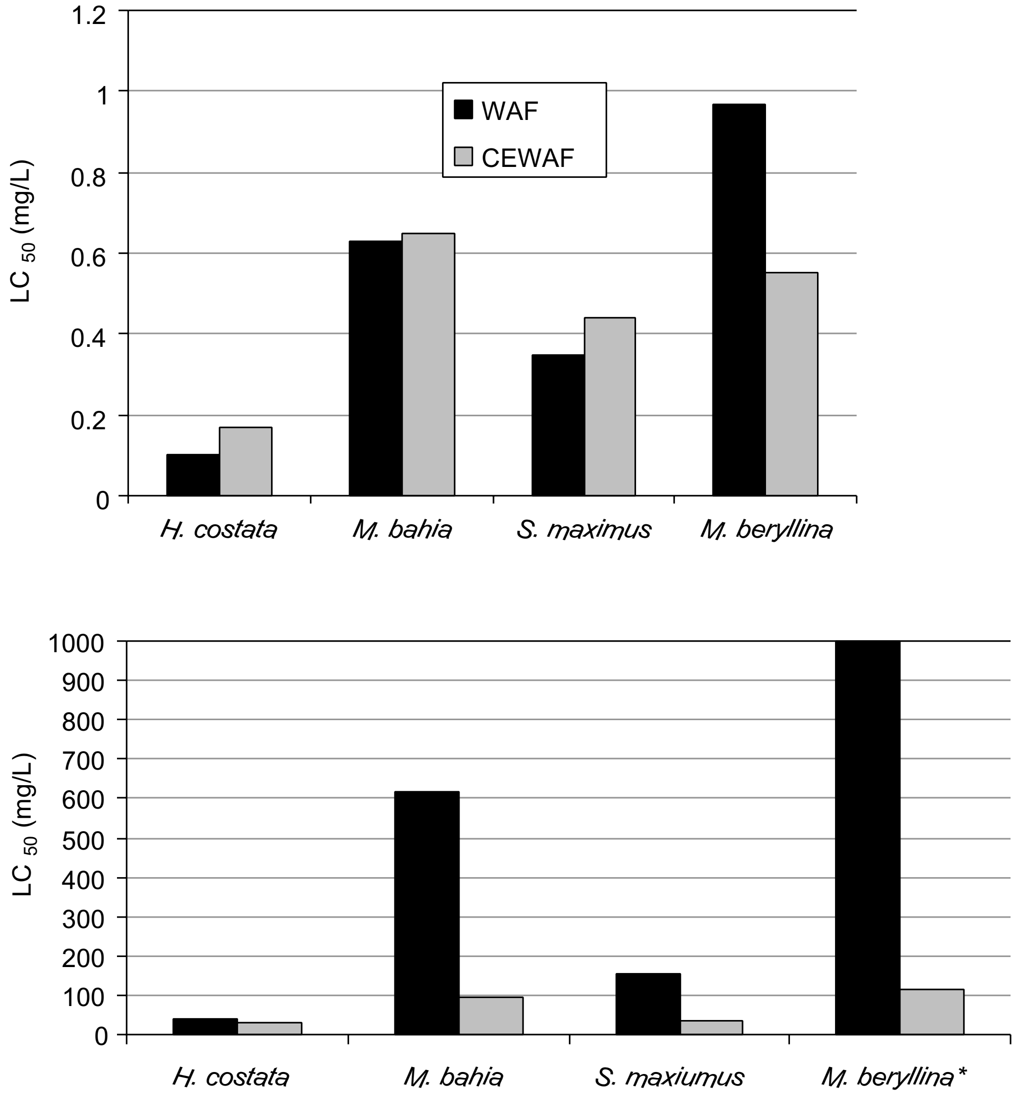


FIGURE 5-6 Comparison of expressing toxicity in terms of measured lethal concentrations (LC) of total petroleum hydrocarbons (TPH) or lethal loading (LL) concentrations based on nominal "oil added" values. Tests were constant 96-hour static-renewal tests with Kuwait oil and Corexit 9527 for the mysids (*Holmesimysis costata* and *Mysidopsis bahia*) and silversides (*Menidia beryllina*). Exposures of turbot (*Scophthalmus maximus*) were 48 hour exposures with Forties crude oil and Corexit 9500. Data expressed as LL imply that CEWAF is more toxic than WAF, but when expressed as measured TPH, toxicities are roughly equivalent.* The LL_{50} for *M. beryllina* exposed to WAF was 5,020 mg/L, but was not displayed for scaling purposes.
SOURCE: Data are from Clark et al., 2001.

TABLE 5-4 Results of Spiked Exposure Toxicity Tests Using Prudhoe Bay Crude Oil Alone and Combined with Corexit 9527 (O:D ratio = 10:1) from Singer et al., 1998 (Results are expressed as the EC or LC_{50} in mg/L of $THC_{(C7–C30)}$)

	WAF			CEWAF		
Species/Endpoint	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Haliotis						
Larval abnormality	>34.03[a]	>46.99	>33.58	19.09	32.70	17.80
Holmesimysis						
96-h mortality	>34.68	>25.45	>28.55	10.54	10.75	10.83
Initial narcosis	11.31	11.58	15.90	11.07	>38.33	48.03
Atherinops						
96-h mortality	16.34	40.20	35.73	28.60	74.73	34.06
Initial narcosis	26.63	>48.22	31.76	>101.82	>140.97	>62.22

[a]EC/LC_{50} estimated to be above the highest test concentration.

leum hydrocarbons between CEWAF and WAF due to differences in mixing energy and loading rates used to prepare the exposure media. For example, WAF solutions were found to have a larger proportion of volatiles (96 percent) as compared to the CEWAF (67 percent). They conclude that different fractions of oil may drive toxicity in different types of solutions. Consequently, reporting toxicity based on only a few of the oil components may make comparisons across studies difficult (see Figure 5-6).

A similar conclusion was drawn by Fucik et al. (1994) in a series of tests comparing the toxicity of chemically dispersed oil, dispersant (Corexit 9527), and WAF to a variety of fish and invertebrate species and life stages from the Gulf of Mexico. Fucik et al. (1994) reported that the toxicity of dispersed oil was proportionately less than WAF when results were compared using a Toxicity Index (TI) applied to the measured TPH data. The TI expresses toxicity as a function of concentration and duration of exposure (e.g., ppm-h). Experiments included both static renewal and flow-through exposures in open containers that allowed significant volatilization of the petroleum constituents. To explain this result, Fucik et al. (1994) speculated that volatilization from dispersed oil was enhanced compared to WAF. Therefore, concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) were higher in WAF, potentially enhancing toxicity in these exposures. Alternatively, they suggested that oil droplets

or emulsions in the chemically dispersed oil may have lower bioavailability than the dissolved hydrocarbons. This explanation seems unlikely given recent studies suggesting that oil droplets may enhance uptake of petroleum hydrocarbons (Payne and Driskell, 2003; Ramachandran et al., 2004).

In conclusion, there is no compelling evidence that the toxicity of chemically dispersed oil is enhanced over physically dispersed oil if comparisons are based on measured concentrations of petroleum hydrocarbons in the water column. This conclusion is further discussed in the section on toxicological effects of dispersed oil on water column organisms. A similar conclusion was reached in the NRC (1989) review of oil dispersants. CROSERF testing protocols recommend analyzing total hydrocarbon content (composed of total petroleum hydrocarbons and volatile hydrocarbons) at a minimum, but also suggest in-depth investigations include the analysis of PAH (Singer et al., 2000; Table 5-5). The studies reviewed above clearly indicated that measuring fractional components of aqueous oil (e.g., TPH, total PAH, total volatiles) may not give the resolution necessary to adequately interpret toxicity test data. Consequently, it is recommended that chemical analyses in conjunction with toxicity tests should routinely include dissolved- and oil droplet-phase analyses of the full suite of parent and alkyl-substituted PAH and heterocyclics as well as the n-alkanes that typically comprise the THC. In addition, application of additive toxicity models for PAH and other petroleum constituents may facilitate the interpretation of toxicity test results.

Although acute toxicity studies do not indicate differences in the lethal or sublethal responses of organisms exposed to chemically dispersed or untreated oil, some studies have suggested that the bioaccumulation kinetics of PAH from dispersed oil may differ from those for undispersed oil. In a series of experiments, Wolfe et al. (1998a,b,c; 1999a; 2001) have investigated the bioavailability of naphthalene and phenanthrene in chemically dispersed oil versus WAF, including an assessment of uptake and depuration kinetics, to address the question of whether dispersants alter bioavailability of compounds. The premise of these experiments was that the bioavailability of dispersed oil may be enhanced due to interactions between dispersant, oil, and biological membranes, possibly as a result of dispersant-mediated changes in membrane permeability, osmoregulation, or other cellular mechanisms. Several experiments examined bioaccumulation of naphthalene as a model PAH by the microalga *Isochrysis galbana*. Naphthalene was selected because it has negligible dispersant facilitated solubility such that changes in bioavailability could be examined in the absence of differences in dissolved-phase concentrations between dispersed and untreated oil. In these experiments, algal cells were exposed to laboratory preparations of either WAF of Prudhoe Bay crude

TABLE 5-5 Recommended Target Analyte List for PAH from Singer et al. (2000)

Naphthalene	Fluoranthene
C-1 naphthalenes	Pyrene
C-2 naphthalenes	C-1 pyrenes
C-3 naphthalenes	C-2 pyrenes
C-4 naphthalenes	C-3 pyrenes
Biphenyl	C-4 pyrenes
Fluorene	Benzo(a,h)anthracene
C-1 fluorenes	Chrysene
C-2 flurorenes	C-1 chrysenes
C-3 fluorenes	C-2 chrysenes
Dibenzothiophene	C-3 chrysenes
C-1 dibenzothiophenes	C-4 chrysenes
C-2 dibenzothiophenes	Benzo(b)fluoranthene
C-3 dibenzothiophenes	Benzo(k)fluoranthene
C-4 dibenzothiophenes	Benzo(e)pyrene
Phenanthrene	Benzo(a)pyrene
C-1 phenanthrenes	Perylene
C-2 phenanthrenes	Indeno(g,h,i)pyrene
C-3 phenanthrenes	Dibenzo(a,h)anthracene
C-4 phenanthrenes	Benzo(1,2,3-cd)perylene

oil (PBCO) or dispersed oil mixture of PBCO and Corexit 9527 spiked with [U-^{14}C] naphthalene. Results suggest that dispersants enhanced the initial uptake of naphthalene by microalgae under a variety of temperature and salinity conditions. However, there were no differences in bioaccumulation as indicated by similarity in bioaccumulation factors between dispersed oil and WAF, suggesting that depuration rates were also enhanced. Wolfe et al. (1998a,b,c; 1999a,b; 2001) extended these experiments to a model food chain, including *I. galbana*, the rotifer *Brachionus plicatilis*, and larval topsmelt, *Atherinops affinis.* Direct aqueous exposures to phenanthrene and naphthalene were compared with aqueous plus dietary exposures. Depuration of phenanthrene by rotifers decreased significantly following dispersed oil exposures, while uptake and depuration of naphthalene by larval topsmelt significantly increased in both aqueous and dietary exposures to dispersed oil. These detailed and elegant experiments have enhanced our understanding of the bioaccumulation kinetics of dispersed oil PAH. These studies should be expanded to include other organisms and PAH. In addition, this model food chain could also be used to answer questions related to the importance of PAH uptake via the dissolved versus oil droplet phases.

EFFECTS ON BIOLOGICAL COMMUNITIES

In the sections that follow, the recent (post-1989) literature on the toxicological effects of chemically dispersed oil is reviewed by habitat type. A detailed review on dispersant toxicity studies pre-1989 was provided in NRC (1989). Besides avoiding duplication, for the most part these earlier studies are not included because many were based on comparisons using the older dispersant formulations and limited by the use of nominal exposures. Studies from freshwater systems are included where possible. It is noted, however, that the amount of literature concerned with dispersants and chemically dispersed oil effects on freshwater organisms is sparse, most likely a function of the fact that the most common U.S. dispersants, Corexit 9500 and 9527, have low efficacy in freshwater. Furthermore, the use of dispersants in freshwater is assumed to be unlikely because the increase in water-column burden of hydrocarbons would preclude their use in freshwater systems that provide a source of drinking water.

Water-Column Organisms

This section reviews the literature pertaining to dispersed oil effects on water column organisms, including larval stages of benthic organisms (Tables 5-6, 5-7, and 5-8). The review was limited by many studies that are still based on comparisons of nominal concentrations, despite the recommendation made in NRC (1989) that future studies include chemical analyses of the exposure media. One common technique is to measure TPH (and /or VOC and PAH) in the stock solutions and infer TPH levels upon serial dilutions of these solutions. While this is an improvement over the use of purely nominal values, it still limits the interpretation of the results unless some minimal and random sampling of test exposures provides confirmation that expected concentrations approximate measured concentrations. It is extremely important to provide an estimate of exposure based on measured concentrations when conducting toxicity tests.

In general, studies that concluded that chemically dispersed oil was more toxic were based on nominal loading of oil, not measured concentrations. For example, Clark et al. (2001) using three types of oil (variable loadings), two dispersants (Corexit 9500 and 9527), continuous and short-term spiked exposures, and early life stages of several marine organisms in 46 and 96 hr tests found that physically dispersed oil appears less toxic than chemically dispersed oil when LC_{50}s were expressed as nominal loading concentrations (see earlier in Chapter 5). When toxicity effects were based on measured TPH, no difference between chemically and physically dispersed oil was observed using continuous exposures. In an exposure study using freshwater fish, Pollino and Holdaway (2002b) con-

TABLE 5-6 Acute Effects of Chemically Dispersed Oil in Comparison to Physically Dispersed Oil in Water-Column Organisms (studies since 1989)

Species	Oil (D:O ratio)	Dispersant	Exposure (hr)	Type of Exposure (static/flow-through)
(1) Marine studies:				
MOLLUSCS				
Crassostrea gigas (Pacific oyster)	Kuwait (1:10)	Corexit 9527	48	constant
Crassostrea gigas	Kuwait (1:10)	Corexit 9527	48	spiked
Crassostrea gigas	Forties crude (1:10)	Corexit 9500	48	constant
Crassostrea gigas	Forties crude (1:10)	Corexit 9500	48	spiked
Crassostrea gigas	Medium fuel oil (1:10)	Corexit 9527	48	constant
Crassostrea gigas	Medium fuel oil (1:10)	Corexit 9527	48	spiked
Octopus pallidus (octopus)	BSC (1:50)	Corexit 9527	24	semi-static
Octopus pallidus	BSC (1:50)	Corexit 9527	48	semi-static
CRUSTACEANS				
Balanus amphitrite (barnacle)	Diesel oil (1:10)	Vecom B-1425	24	static
Balanus amphitrite	Diesel oil (1:10)	Vecom B-1425	48	static
Balanus amphitrite	Diesel oil (1:10)	Norchem OSD-570	24	static
Balanus amphitrite	Diesel oil (1:10)	Norchem OSD-570	48	static
Palaemon serenus (ghost shrimp)	BSC (1:10)	Corexit 9500	96	static (50% daily renewal)
Palaemon serenus	BSC (1:10)	Corexit 9527	96	static (50% daily renewal)
Palaemon elegans (prawn)	Middle East Crude Oil	Not disclosed	24	static
Allorchestes compressa (Amphipod)	BSC (1:10)	Corexit 9527	96	static (60% daily renewal)
Allorchestes compressa	BSC (1:10)	Corexit 9500	96	static (60% daily renewal)
Mysidopsis bahia (gulf mysid shrimp)	Kuwait (1:10)	Corexit 9527	96	constant
Mysidopsis bahia	Kuwait (1:10)	Corexit 9527	96	spiked
Mysidopsis bahia	Kuwait (W) (1:10)	Corexit 9527	96	constant

Endpoint	Oil Treatment Effect Conc. (LC_{50}) mg/L	Dispersed Oil Effect Conc. (LC_{50}) mg/L	Concentration Estimate[e]	Reference
larval mortality	NA	0.5	Initial TPH	Clark et al., 2001
larval mortality	NA	1.92	Initial TPH	Clark et al., 2001
larval mortality	NA	0.81	Initial TPH	Clark et al., 2001
larval mortality	NA	3.99	Initial TPH	Clark et al., 2001
larval mortality	>1.14	0.53	Initial TPH	Clark et al., 2001
larval mortality	>1.83	2.28	Initial TPH	Clark et al., 2001
hatchling mortality	0.51	3.11	Average TPH over 24 hr	Long and Holdaway, 2002
hatchling mortality	0.39	1.8	Average TPH over 24 hr	Long and Holdaway, 2002
larval mortality	NA	514	Initial nominal[a]	Wu et al., 1997
larval mortality	NA	48	Initial nominal[a]	Wu et al., 1997
larval mortality	NA	505	Initial nominal[a]	Wu et al., 1997
larval mortality	NA	71	Initial nominal[a]	Wu et al., 1997
mortality	258,000	3.6	Initial nominal	Gulec and Holdaway, 2000
mortality	258,000	8.1	Initial nominal	Gulec and Holdaway, 2000
mortality	83.5[b]	1.1[b]	Initial nominal	Unsal, 1991
mortality	311,000	16.2	Initial nominal	Gulec et al., 1997
mortality	311,000	14.8	Initial nominal	Gulec et al., 1997
mortality	0.63	0.65	Initial TPH	Clark et al., 2001
mortality	>2.93	17.2	Initial TPH	Clark et al., 2001
mortality	NA	0.11	Initial TPH	Clark et al., 2001

continues

TABLE 5-6 Continued

Species	Oil (D:O ratio)	Dispersant	Exposure (hr)	Type of Exposure (static/flow-through)
Mysidopsis bahia	Kuwait (W) (1:10)	Corexit 9527	96	spiked
Mysidopsis bahia	Forties crude (1:10)	Corexit 9500	96	constant
Mysidopsis bahia	Forties crude (1:10)	Corexit 9500	96	spiked
Mysidopsis bahia	AMC (W) (1:10)	Corexit 9500	96	spiked
Mysidopsis bahia	AMC (W) (1:10)	Corexit 9500	96	static (75% daily renewal), sealed
Mysidopsis bahia	ANS (1:10)	Corexit 9500	96	spiked
Mysidopsis bahia	ANS (1:10)	Corexit 9500	96	continuous
Mysidopsis bahia	VCO (1:10)	Corexit 9500	96	static (90% daily renewal), sealed
Mysidopsis bahia	VCO (1:10)	Corexit 9500	96	spiked
Mysidopsis bahia	PBCO (1:10)	Corexit 9500	96	spiked
Mysidopsis bahia	VCO (W) (1:10)	Corexit 9500	96	spiked
Mysidopsis bahia	KCO (1:10)	Corexit 9527	96	spiked
Mysidopsis bahia	KCO (1:10)	Corexit 9527	96	static daily renewal, sealed
Holmesimysis costata (kelp mysid shrimp)	Kuwait (1:10)	Corexit 9527	96	constant
Holmesimysis costata	Kuwait (1:10)	Corexit 9527	96	spiked
Holmesimysis costata	PBCO (1:10)	Corexit 9527	96	spiked
Americamysis (Holmesimysis) costata (kelp forest mysid)	PCBO (1:10)	Corexit 9500	96	spiked
Americamysis (Holmesimysis) costata	PCBO (W) (1:10)	Corexit 9500	96	spiked
CNIDARIANS				
Hydra viridissima (green hydra)	BSC (1:29)	Corexit 9527	96	static
Hydra viridissima	BSC (1:29)	Corexit 9500	96	static
FISH				
Clupea pallasi (Pacific herring)	Weathered ANS (1:25)	Corexit 9527	24	static

Endpoint	Oil Treatment Effect Conc. (LC_{50}) mg/L	Dispersed Oil Effect Conc. (LC_{50}) mg/L	Concentration Estimate[e]	Reference
mortality	>0.17	111	Initial TPH	Clark et al., 2001
mortality	NA	0.42	Initial TPH	Clark et al., 2001
mortality	NA	15.3	Initial TPH	Clark et al., 2001
larval mortality	26.1–83.1	56.5–60.8	Initial TPH	Fuller and Bonner, 2001
larval mortality	0.56–0.67	0.64–0.65	Initial TPH	Fuller and Bonner, 2001
larval mortality	8.21	5.08	Initial THC	Rhoton et al., 2001
larval mortality	2.61	1.4	Initial THC	Rhoton et al., 2001
larval mortality	0.15–0.4	0.50–0.53	Average TPH	Wetzel and van Fleet, 2001
larval mortality	0.59–0.89	10.2–18.1	Average TPH	Wetzel and van Fleet, 2001
larval mortality	>6.86	15.9	Average TPH	Wetzel and van Fleet, 2001
larval mortality	>0.63–>0.83	72.6–120.8	Average TPH	Wetzel and van Fleet, 2001
mortality	>2.9	17.7	Initial TPH	Pace et al., 1995
mortality	0.78	0.98	Initial TPH	Pace et al., 1995
mortality	0.1	0.17	Initial TPH	Clark et al., 2001
mortality	>2.76	1.8	Initial TPH	Clark et al., 2001
juvenile mortality	>25.45–>34.68	10.54–10.83	Initial THC[c]	Singer et al., 1998
early-life stage mortality	14.23–>17.5	9.46–14.40	Initial THC[c]	Singer et al., 2001
early-life stage mortality	0.951–>1.03	5.72–33.27	Initial THC[c]	Singer et al., 2001
mortality	0.7	9	Initial stock TPH	Mitchell and Holdaway, 2000
mortality	0.7	7.2	Initial stock TPH	Mitchell and Holdaway, 2000
larval mortality	~0.045	0.199	Initial tPAH	Barron et al., 2004

continues

TABLE 5-6 Continued

Species	Oil (D:O ratio)	Dispersant	Exposure (hr)	Type of Exposure (static/flow-through)
Cyprinodon variegatus (sheepshead minnow)	No. 2 fuel oil (1:1 to 1:10)	Omniclean	96	static
Cyprinodon variegatus	AMC (W) (1:10)	Corexit 9500	96	spiked
Cyprinodon variegatus	AMC (W) (1:10)	Corexit 9500	96	static (75% daily renewal), sealed
Atherinops affinis (topsmelt)	PBCO (1:10)	Corexit 9527	96	spiked
Atherinops affinis	PBCO (1:10)	Corexit 9500	96	spiked
Atherinops affinis	PBCO (W) (1:10)	Corexit 9500	96	spiked
Scophthalamus maxiumus (turbot)	Kuwait (1:10)	Corexit 9527	48	constant
Scophthalamus maxiumus	Kuwait (1:10)	Corexit 9527	48	spiked
Scophthalamus maxiumus	Forties (1:10)	Corexit 9500	48	constant
Scophthalamus maxiumus	Forties (1:10)	Corexit 9500	48	spiked
Menidia beryllina (Inland silveride)	Kuwait (1:10)	Corexit 9527	96	constant
Menidia beryllina	Kuwait (1:10)	Corexit 9527	96	spiked
Menidia beryllina	Kuwait (W) (1:10)	Corexit 9527	96	constant
Menidia beryllina	Kuwait (W) (1:10)	Corexit 9527	96	spiked
Menidia beryllina	Forties (1:10)	Corexit 9500	96	constant
Menidia beryllina	Forties (1:10)	Corexit 9500	96	spiked
Menidia beryllina	PBCO (1:10)	Corexit 9500	96	spiked
Menidia beryllina	ALC (W) (1:10)	Corexit 9500	96	spiked
Menidia beryllina	ALC (W) (1:10)	Corexit 9500	96	static (75% daily renewal), sealed
Menidia beryllina	PBCO (W) (1:10)	Corexit 9500	96	spiked
Menidia beryllina	ANS (1:10)	Corexit 9500	96	spiked
Menidia beryllina	ANS (1:10)	Corexit 9500	96	continuous
Menidia beryllina	PBCO (1:10)	Corexit 9500	96	spiked
Menidia beryllina	PBCO (1:10)	Corexit 9500	96	continuous
Menidia beryllina	VCO (1:10)	Corexit 9500	96	static (90% daily renewal), sealed
Menidia beryllina	VCO (1:10)	Corexit 9500	96	spiked
Menidia beryllina	PBCO (1:10)	Corexit 9500	96	spiked

Endpoint	Oil Treatment Effect Conc. (LC_{50}) mg/L	Dispersed Oil Effect Conc. (LC_{50}) mg/L	Concentration Estimate[e]	Reference
larval mortality	94	~ 80–165[d]	Nominal initial mg/L	Adams et al., 1999
larval mortality	>5.7–6.1	31.9–39.5	Initial TPH	Fuller and Bonner, 2001
larval mortality	3.9–4.2	>9.7–10.8	Initial TPH	Fuller and Bonner, 2001
larval mortality	16.34–40.20	28.6–74.73	Initial THC	Singer et al., 1998
early life stage mortality	9.35–12.13	7.27–17.70	Initial THC	Singer et al., 2001
early life stage mortality	>1.45–>1.60	16.86–18.06	Initial THC	Singer et al., 2001
mortality	NA	2	Initial TPH	Clark et al., 2001
mortality	NA	16.5	Initial TPH	Clark et al., 2001
mortality	0.35	0.44	Initial TPH	Clark et al., 2001
mortality	>1.33	48.6	Initial TPH	Clark et al., 2001
mortality	0.97	0.55	Initial TPH	Clark et al., 2001
mortality	>1.32	6.45	Initial TPH	Clark et al., 2001
mortality	0.14	1.09	Initial TPH	Clark et al., 2001
mortality	>0.66	10.9	Initial TPH	Clark et al., 2001
mortality	NA	0.49	Initial TPH	Clark et al., 2001
mortality	NA	9.05	Initial TPH	Clark et al., 2001
early life stage mortality	11.83	32.47	Initial THC	Singer et al., 2001
larval mortality	>14.5–32.3	24.9–36.9	Initial TPH	Fuller and Bonner, 2001
larval mortality	4.9–5.5	1.5–2.5	Initial TPH	Fuller and Bonner, 2001
early life stage mortality	NA	20.28	Initial THC	Singer et al., 2001
larval mortality	26.36	12.22	Initial THC	Rhoton et al., 2001
larval mortality	15.59	12.42	Initial THC	Rhoton et al., 2001
larval mortality	>19.86	12.29	Initial THC	Rhoton et al., 2001
larval mortality	14.81	4.57	Initial THC	Rhoton et al., 2001
larval mortality	<0.11	0.68	Average TPH	Wetzel and van Fleet, 2001
larval mortality	0.63	2.84	Average TPH	Wetzel and van Fleet, 2001
larval mortality	>6.86	18.1	Average TPH	Wetzel and van Fleet, 2001

continues

TABLE 5-6 Continued

Species	Oil (D:O ratio)	Dispersant	Exposure (hr)	Type of Exposure (static/flow-through)
Menidia beryllina	VCO (W) (1:10)	Corexit 9500	96	spiked
Menidia beryllina	ANS (W) (1:10)	Corexit 9500	96	continuous
Menidia beryllina	ANS (W) (1:10)	Corexit 9500	96	spiked
Sciaenops ocellatus (Red drum)	VCO (1:10)	Corexit 9500	96	spiked
Macquaria novemaculeata (Australian bass)	BSC (1:10)	Corexit 9500	96	static (50% daily renewal)
Macquaria novemaculeata	BSC (1:10)	Corexit 9527	96	static (50% daily renewal)
Macquaria novemaculeata	BSC (1:50)	Corexit 9527	96	static daily renewal
(2) Freshwater studies:				
CNIDARIANS				
Hydra viridissima (green hydra)	BSC (1:29)	Corexit 9527	96	static
Hydra viridissima	BSC (1:29)	Corexit 9500	96	static
FISH				
Melanotaenia fluviatilis (crimson-spotted rainbowfish)	BSC (1:50)	Corexit 9500	24	static, daily renewal
Melanotaenia fluviatilis	BSC (1:50)	Corexit 9500	48	static, daily renewal
Melanotaenia fluviatilis	BSC (1:50)	Corexit 9500	72	static, daily renewal
Melanotaenia fluviatilis	BSC (1:50)	Corexit 9500	96	static, daily renewal
Melanotaenia fluviatilis	BSC (1:50)	Corexit 9527	48	static, daily renewal
Melanotaenia fluviatilis	BSC (1:50)	Corexit 9527	72	static, daily renewal
Melanotaenia fluviatilis	BSC (1:50)	Corexit 9527	96	static, daily renewal

[a]Nominal; concentrations refer to the quantity of dispersant:diesal mixture.
[b]Percent of stock solution.
[c]THC, total hydrocarbon content of C_7 to C_{30} compounds.
[d]Depending on dispersant concentration from 1:1 to 1:10 dispersant to oil ratio.
[e]Effects concentrations based on initial chemical quantiations (measured or nominal).

Endpoint	Oil Treatment Effect Conc. (LC_{50}) mg/L	Dispersed Oil Effect Conc. (LC_{50}) mg/L	Concentration Estimate[e]	Reference
larval mortality	>1.06	30.8	Average TPH	Wetzel and van Fleet, 2001
larval mortality	0.79	0.65	Initial THC	Rhoton et al., 2001
larval mortality	>1.13	18.89	Initial THC	Rhoton et al., 2001
larval mortality	0.85	4.23	Average TPH	Wetzel and van Fleet, 2001
larval mortality	465,000	14.1	Initial nominal	Gulec and Holdaway, 2000
larval mortality	465,000	28.5	Initial nominal	Gulec and Holdaway, 2000
mortalilty			Initial TPH on stocks	Cohen and Nugegoda, 2000
mortality	0.7	9	Initial stock TPH	Mitchell and Holdaway, 2000
mortality	0.7	7.2	Initial stock TPH	Mitchell and Holdaway, 2000
embryo mortality	4.48	2.62	Initial stock TPH	Pollino and Holdaway, 2002b
embryo mortality	3.38	1.94	Initial stock TPH	Pollino and Holdaway, 2002b
embryo mortality	2.1	1.67	Initial stock TPH	Pollino and Holdaway, 2002b
embryo mortality	1.28	1.37	Initial stock TPH	Pollino and Holdaway, 2002b
embryo mortality	3.38	2.92	Initial stock TPH	Pollino and Holdaway, 2002b
embryo mortality	2.1	1.25	Initial stock TPH	Pollino and Holdaway, 2002b
embryo mortality	1.28	0.74	Initial stock TPH	Pollino and Holdaway, 2002b

NOTE: THC, summation of total hydrocarbon content C_6 to C_{36}; (W), weathered; ANS, Alaska North Slope crude oil; PBCO, Prudhoe Bay crude oil; BSC, Bass Strait crude oil; ALC, Arabian light crude; VCO, Venezuelan medium crude oil.

TABLE 5-7 Sublethal Effects of Chemically Dispersed Oil in Comparison to Physically Dispersed Oil in Water-Column Organisms (studies since 1989)

Species	Life Stage	Oil	Dispersant (D:O ratio)	Exposure (hr)	Type of Exposure (Static/Flow-through)	Endpoint
(1) Marine studies:						
CRUSTACEANS						
Holmesimysis costata (kelp mysid shrimp)	Adult	PBCO	Corexit 9527 (1:10)	96	spiked-flow through	initial narcosis
Balanus amphitrite (barnacle)	Larvae	Diesel oil	Vecom B-1425 (1:10)	24	static	phototaxis inhibition
Balanus amphitrite (barnacle)	Larvae	Diesel oil	Vecom B-1425 (1:10)	48	static	phototaxis inhibition
Balanus amphitrite (barnacle)	Larvae	Diesel oil	Norchem OSD-570 (1:10)	24	static	phototaxis inhibition
Balanus amphitrite (barnacle)	Larvae	Diesel oil	Norchem OSD-570 (1:10)	48	static	phototaxis inhibition
MOLLUSCS						
Haliotis rufescens (red abalone)	Adult	PBCO	Corexit 9527 (1:10)	48	spiked-flow through	larval abnormality
FISH						
Atherinops affinis (topsmelt)	Adult	PBCO (variable)	Corexit 9527 (1:10)	96	spiked-flow through	initial narcosis
Clupea pallasi (Pacific herring)	embryos/ larvae	ANS (W)	Corexit 9257 (1:25)	24 (larval),[a] 96 (eggs)[a]	static. Daily renewal (for egg studies)	hatching time

Oil Treatment Effect Conc. (EC_{50}) mg/L	Dispersed Oil Effect Conc.	Concentration Estimate[c]	Comments	Reference
11.31–15.90	111.07–48.03	Initial THC		Singer et al., 1998
NA	LOEC; 400[b]	Initial nominal	No oil alone comparison.	Wu et al., 1997
NA	LOEC; 60L[b]	Initial nominal		Wu et al., 1997
NA	LOEC; 400[b]	Initial nominal		Wu et al., 1997
NA	LOEC; 80[b]	Initial nominal		Wu et al., 1997
> 33.58–>46.99	17.81–32.70	Initial THC		Singer et al., 1998
16.34–40.20	>62.22–>140.97	Initial THC		Singer et al., 1998
NA	NA	Initial tPAH	1 µm filtering of WAF/DO. Similar toxicity WAF & DO in control and UVA treatments but DO more toxic in sunlight.	Barron et al., 2003

continues

TABLE 5-7 Continued

Species	Life Stage	Oil	Dispersant (D:O ratio)	Exposure (hr)	Type of Exposure (Static/Flow-through)	Endpoint
Clupea pallasi	Embryos/larvae	ANS (W)	Corexit 9257 (1:25)	24 (larval),[a] 96 (eggs)[a]	static. Daily renewal (for egg studies)	Hatching success
Clupea pallasi	Embryos/larvae	ANS (W)	Corexit 9257 (1:25)	24 (larval),[a] 96 (eggs)[a]	static. Daily renewal (for egg studies)	Larval abnormalities
Macquaria novemaculeata (Australian bass)	Juvenile	BSC	Corexit 9527 (1:30)	96	constant flow-through (2% of stock prepared daily)	Cytochrome C oxidase (CCO)
Macquaria novemaculeata	Juvenile	BSC	Corexit 9527 (1:30)	96	constant flow-through (2% of stock prepared daily)	Lactate dehydrogenase (LDH)
Macquaria novemaculeata	Juvenile	BSC	Corexit 9527 (1:30)	96	constant flow-through (2% of stock prepared daily)	Oxygen consumption rate
Menidia beryllina (Inland silversides)	Embryonic/larval	No. 2 Fuel Oil	Corexit 7664 (1:40) and 9527 (1:50)	240	static	Teratogenic endponts
Salmo salar (Atlantic salmon)	Immature	BSC	Corexit 9527 (1:50)	144 (plus 29 days recovery)	constant flow-through (1% of stock WAF)	Serum sorbitol dehydrogenase (SDH; indicator of liver damage)

Oil Treatment Effect Conc. (EC_{50}) mg/L	Dispersed Oil Effect Conc.	Concentration Estimate[c]	Comments	Reference
NA	NA	Initial tPAH	1 µm filtering of WAF/DO. Similar toxicity WAF & DO in control and UVA treatments but DO more toxic in sunlight.	Barron et al., 2003
NA	NA	Initial tPAH	1 µm filtering of WAF/DO. Similar toxicity WAF & DO in control and UVA treatments but DO more toxic in sunlight.	Barron et al., 2003
NA	NA	Initial TPH on stocks	Stimulated activity if DO cf WAF in gills; in livers stimulated in both WAF and DO WAF. DO WAF concentrations >5x higher cf. WAF	Cohen et al., 2001a
NA	NA	Initial TPH on stocks	LDH activity higher in DO WAF cf WAF. DO WAF concentrations >5x higher cf. WAF	Cohen et al., 2001a
NA	NA	Initial TPH on stocks	Oxygen consumption higher in DO WAF cf WAF. DO WAF concentrations >5x higher cf. WAF	Cohen et al., 2001a
NA	NA	Initial THC on stocks	WAF effect only at 100% stock solution; WAF 7664 effects at 1% stock and WAF 9527 at 10%.	Middaugh and Whiting, 1995
NA	NA	Initial TPH	No change with any treatment.	Gagnon and Holdaway, 1999

continues

TABLE 5-7 Continued

Species	Life Stage	Oil	Dispersant (D:O ratio)	Exposure (hr)	Type of Exposure (Static/Flow-through)	Endpoint
Salmo salar	Immature	BSC	Corexit 9527 (1:50)	144 (plus 29 days recovery)	constant flow-through (1% of stock WAF)	Hepatic EROD activity
Cyprinodon variegatus (sheepshead minnow)	0–24 h old fry	No. 2 Fuel oil	Omniclean (1:1 to 1:10)	168 (ELS)	static	Biomass
ALGAE						
Scenedesmus armatus (chlorococcal alga)	NA	No. 2 Fuel oil	DP 105 (1:20)	24	static	Variety of growth and reproductive endpoints
Isochrysis galbana	NA	PBCO	Corexit 9527 (1:100)	24	static	HSP60
ECHINODERM						
Coscinasterias muricata (eleven-armed asteroid)	Adult	BSC	Corexit 9500 (1:10)	96	Daily static renewal	Alkaline phosphatase activity (AP), cytochrome P450, behavioral assays
ROTIFERA						
Brachionus plicatilis (rotifer)	Adult	PBCO	Corexit (1:50)	8 to 24	static	Heat-shock 60

Oil Treatment Effect Conc. (EC_{50}) mg/L	Dispersed Oil Effect Conc.	Concentration Estimate[c]	Comments	Reference
NA	NA	Initial TPH	Induction of EROD by 2 days in WAF and DO WAF—induction levels higher and more persistent in DO WAF.	Gagnon and Holdaway, 2000
NA	25	Initial nominal	EC_{50}s reported as nominal mixed (oil and/or dispersant) mg/L values. Oil/dispersant mixtures equal or more toxic than oil alone.	Adams et al., 1999
NA	NA	Initial nominal	No clear difference between O and DO mixes. Nominal exposures.	Zachleder and Tukaj, 1993
NA	NA	Initial nominal	No differnce between WAF or DO	Wolfe et al., 1999
NA	NA	Initial PAH	tPAH in stocks WAF 1.8mg/L and dispersed oil 3.5 mg/L. AP no differences. P450 decreased in dispersed oil cf control or WAF. WAF and dispersed oil impacted behavior.	Georgiades et al., 2003
NA	NA	Initial nominal	8 h significant elevations in HSP60 in WAF, only elevated in DO exposures in unfed exposures.	Wheelock et al., 2002

continues

TABLE 5-7 Continued

Species	Life Stage	Oil	Dispersant (D:O ratio)	Exposure (hr)	Type of Exposure (Static/Flow-through)	Endpoint
(2) Freshwater studies:						
CNIDARIANS						
Hydra viridissima (green hydra)	Adult	BSC	Corexit 9527 (1:29)	168	static renewal	population growth rate
Hydra viridissima (green hydra)	Adult	BSC	Corexit 9500 (1:29)	168	static renewal	population growth rate
FISH						
Salmar salmar (rainbow trout)	Juvenile	Mesa sour crude (W)	Corexit 9500 (1:20)	48	static daily renewal	EROD activity (CYP1A induction)
Salmar salmar	Juvenile	Tera Nova	Corexit 9500 (1:20)	48	static daily renewal	EROD activity (CYP1A induction)
Salmar salmar	Juvenile	Scotian light	Corexit 9500 (1:20)	48	static daily renewal	EROD activity (CYP1A induction)
Melanotaenia fluviatilis (Australian crimson-spotted rainbowfish)	Adult	BSC	Corexit 9500 (1:50)	72	50% daily static renewal	EROD activity
Melanotaenia fluviatilis	Adult	BSC	Corexit 9500 (1:50)	72	50% daily static renewal	Citrate synthase activity
Melanotaenia fluviatilis	Adult	BSC	Corexit 9500 (1:50)	72	50% daily static renewal	LDH activity

Oil Treatment Effect Conc. (EC_{50}) mg/L	Dispersed Oil Effect Conc.	Concentration Estimate[c]	Comments	Reference
>0.6	0.6	Initial stock TPH		Mitchell and Holdaway, 2000
>0.6	4	Initial stock TPH		Mitchell and Holdaway, 2000
0.00072	0.0006	Initial TPH and PAH	CYP1A induction x106 in CEWAF (if expressed as % v/v ratio)	Ramachandran et al., 2004
0.0018	0.0015	Initial TPH and PAH	CYP1A induction x1116 in CEWAF (if expressed as % v/v ratio)	Ramachandran et al., 2004
0.00156	0.002	Initial TPH and PAH	CYP1A induction x6 in CEWAF (if expressed as % v/v ratio)	Ramachandran et al., 2004
NA	NA	Initial (daily averages) TPH	Higher activity cf controls in males at 0.8, 2.6, & 7.8 mg/L TPH WAF and in males and females at 14.5 mg/L TPH DCWAF.	Pollino and Holdaway, 2003
NA	NA	Initial (daily averages) TPH	Higher activity cf controls at 2.6 & 7.8 mg/L TPH WAF and 1.4 & 14.5 mg/L TPH DCWAF.	Pollino and Holdaway, 2003
NA	NA	Initial (daily averages) TPH	Higher activity cf controls at 7.8 mg/L TPH WAF and 14.5 mg/L TPH DCWAF.	Pollino and Holdaway, 2003

continues

TABLE 5-7 Continued

Species	Life Stage	Oil	Dispersant (D:O ratio)	Exposure (hr)	Type of Exposure (Static/Flow-through)	Endpoint
Melanotaenia fluviatilis	Adult	BSC	Corexit 9500 (1:50)	72	50% daily static renewal	Plasma estradiol/ testosterone; GSI and histopathology
Melanotaenia fluviatilis	Adult	BSC	Corexit 9500 (1:50)	72	50% daily static renewal	Egg production, % hatch and larval lengths

[a]Followed by UV exposures and assessment of combined effects of PAH accumulation and UV exposure.
[b]Represents mg/l value of oil and/or dispersant mixture.
[c]Effects concentrations based on initial chemical quantiations (measured or nominal).

TABLE 5-8 Dispersed Oil Effects on Water Column Organisms—Field Studies

Species	Treatment	Nominal/ Measured Concentrations	Results	Reference
Plankton, bioassays (*Daphnia*, rainbow trout, and microtox)	*O:* NWC *D:* Corexit 9550 (1:10 D/O ratio) *Details:* Fen lake plots, monitored 29 days before exposure and 30 days post-exposure *Response:* plankton counts, metabolic rate, aqueous microbial counts, bioassays (*Daphnia*, rainbow trout, and microtox)	Measured (fluorescence in field); TPH in lab	Bioassays no toxicity for O or DO plots No change in phyto- or zoo-plankton density, planktonic biomass, metabolic rates, or microbial populations with O or DO plots	Brown et al., 1990

NOTE: O, oil; D, dispersant; DO, chemically dispersed oil; NWC, Norman Wells Crude Oil.

Oil Treatment Effect Conc. (EC_{50}) mg/L	Dispersed Oil Effect Conc.	Concentration Estimate[c]	Comments	Reference
NA	NA	Initial (daily averages) TPH	No significant differences between WAF or DC WAF.	Pollino and Holdaway, 2002a
NA	NA	Initial (daily averages) TPH	No significant differences betweenWAF or DC WAF (high variability), although DC WAF exposure caused cessation in egg production at 14.5 mg/L.	Pollino and Holdaway, 2002a

NOTE: ANS, Alaska North Slope Crude Oil; BSC, Bass Strait Crude Oil; PBCO, Prudhoe Bay Crude Oil; (W), weathered.

cluded that 96-hr LC_{50}s for WAF and chemically dispersed oil were similar for both first- and second-generation fish based on measured TPH concentrations. It should be noted that a complex preparation of the chemically dispersed oil using Corexit 9527 and 9500 was used. The chemically dispersed oil was prepared by mixing oil and water for 24 hr, removing crude oil from the top, and then applying the dispersant to this oil. The chemically dispersed oil was then prepared by adding 1 mL of this mixture to 1L of WAF.

Singer et al. (1998) evaluated the acute effects of untreated and dispersant-treated (Corexit 9527) Prudhoe Bay crude oil on early life stages of three Pacific marine species: the red abalone, *Haliotis rufescens*, a kelp forest mysid shrimp, *Holmesimysis costata,* and the topsmelt, *Atherinops affinis* and concluded that CEWAF versus WAF toxicity was dependent upon test species and exposure time (also see earlier in Chapter 5). Results were expressed as measured THC concentrations and it was observed that WAF was more toxic at early time points (<1 hr), but in tests with *H. rufescens* and *H. costata* significant effects were seen in the CEWAF exposures at THC concentrations two to three times lower than in WAF tests (Table 5-4). Cohen and Nugegoda (2000) exposed fish to Bass Straight crude oil and Corexit 9527 and found that the chemically dispersed oil

was more toxic than WAF, based on a comparison of measured TPH values. As noted previously (see earlier section in this chapter on toxicity of chemically versus physically dispersed oil), these results are likely due to compositional differences in dissolved petroleum hydrocarbons in chemically dispersed oil compared to WAF and argue for more detailed chemical evaluations of exposure. Other studies that indicate an enhanced acute toxicity from dispersed oil on a variety of marine and freshwater organisms are listed in Table 5-6, but are not discussed because they employed nominal exposures.

Since the NRC (1989) recommendation for increased investigations of chronic and sublethal effects of dispersed oil, many studies have been undertaken (sublethal studies summarized in Table 5-7). Many endpoints including molecular targets through behavioral responses have been assessed in a variety of species from phytoplankton to various early life stages of common nearshore benthic and water-column species. Again, several of these studies report nominal exposures (e.g., all of the phytoplankton reports, which demonstrate no effect of chemically dispersed oil versus WAF), although the majority of studies do evaluate at least TPH. Ramachandran et al. (2003) measured induction of hepatic CYP1A in juvenile rainbow trout in WAF and chemically dispersed oil (using Corexit 9500) using three types of crude oil. They found that CYP1A expression (measured as EROD activity) was as much as 1,100 times higher in the CEWAF exposures compared with WAF when results were expressed on a percent (v/v) basis; however, when expressed as measured PAH concentrations there was little difference between the EC_{50} values for EROD activity. Similarly, Cohen et al. (2001a,b) using juvenile fish exposed to Bass Straight crude oil and Corexit 9527 found that chemically dispersed oil increased the response in many of the biochemical indicators examined (e.g., cytochrome C oxidase). Barron et al. (2004) demonstrated that CEWAF and WAF toxicity were similar in exposed fish eggs and larvae. Other studies have demonstrated mixed responses (depending on metrics chosen) or decreased effects of chemically dispersed oil compared to WAF in both marine and freshwater species (e.g., Pollino and Holdaway, 2003; Gagnon and Holdaway, 2000; Wheelock et al., 2002; Georgiades et al., 2003).

Intertidal and Subtidal Habitats

These habitats include benthic invertebrates and plants inhabiting subtidal and intertidal areas in both hard and soft-bottom environments, as well as intertidal wetlands. Under most deepwater spill scenarios (>10 m), use of dispersants is thought to present minimal risk to benthic subtidal communities because water-column concentrations of petroleum

hydrocarbon will be sufficiently dilute (McAuliffe et al., 1981; Mackay and Wells, 1983). In shallow-water systems, these organisms are more likely to be exposed to and affected by dispersed rather than floating oil. Consequently, increased impacts on subtidal benthic resources may be one of the environmental trade-offs of using dispersants. Intertidal areas, such as salt marshes and mangroves, are often considered sensitive areas because they serve as habitat for many adult, juvenile, and larval organisms. Hence, if valuable resources exist in the intertidal area, dispersing oil before it reaches this habitat may be preferable. In terms of short-term effects, an extensive evaluation of the relative acute sensitivities of benthic and water-column species to a variety of chemicals, including PAH, suggests that the toxicity of dispersed oil to benthic organisms would be similar to that on water-column organisms (DiToro et al., 1991). However, this evaluation does not consider the potential for long-term exposure to oil that may occur as a result of the persistence of oil in sediments, particularly in low-energy areas with minimal flushing. Thus, in order to adequately evaluate the potential effects on subtidal and intertidal temperate communities in shallow water systems, the persistence and behavior of dispersed oil versus untreated oil in benthic sediments and on the shoreline should be assessed. Field studies conducted in the 1980s still constitute much of what is known about these fate and effects processes and are summarized below.

In 1981, a field study in Long Cove, Searsport, Maine compared the fate and effects of dispersed and undispersed crude oil on nearshore temperate habitats (Gilfillan et al., 1986). The cove was divided into three areas: a control, dispersed oil (using Corexit 9527), and untreated oil. The spill of 250 gallons of untreated oil was released during high tide in water approximately 1.5 to 2.0 m deep. The oil was allowed to coat the beach and after two tidal cycles, oil was cleansed from the beach using conventional methods. The dispersed oil (10:1, O:D) was mixed and released into approximately 2.5 to 3.0 m. The deepest samples were taken near the center of the cove, in approximately 18 m depth. The treated oil quickly dispersed into the water column, reaching concentrations of 15–20 ppm near the bottom. However, this short-term exposure appeared to have little effect on the benthic community in this treatment. On the other hand, significant amounts of oil remained in the intertidal sediments exposed to untreated oil, but not in sediments exposed to the dispersed oil. In addition, hydrocarbons were found in clams and mussels near the untreated oil site, but were not detected in similar species collected at the dispersed oil site. Finally, effects on infaunal benthic communities were found in the untreated oil site but not in the area exposed to dispersed oil. Researchers attributed these differences to the greater persistence of undispersed oil in the intertidal sediments.

Similar results were seen in the Baffin Island Oil Spill Project (BIOS) initiated in 1980 (Blackall and Sergy, 1981). This large-scale field project consisted of four bays, two of which received either 94 barrels of untreated, partly weathered crude oil released on the surface or an underwater release of oil and dispersant (10:1). The untreated oil caused no immediate effects on benthic organisms, but some intertidal amphipods and larval fish were affected by physical coating. Oil concentrations in the top 1 m of water ranged from 0.01 to 2.8 ppm. In the dispersed oil treatment, concentrations of oil on the bottom (approximately 10 m) ranged from approximately 50 ppm to a high of 167 ppm. Benthic organisms appeared stressed in this treatment, most likely due to narcotic effects. However, systematic monitoring of benthic populations demonstrated that exposure to dispersed oil did not cause large-scale mortality. After one year, there was no statistical difference in benthic community composition between the dispersed oil treatment and the control bays. As in the Searsport study, the persistence of dispersed oil in subtidal sediments was much less (approaching background after 1 year) than at the untreated oil site. However, in this study there was no attempt to recover oil from the untreated oil site; hence, amounts of residual oil were likely higher than would have occurred had some recovery been attempted.

Michel and Henry (1997) evaluated PAH uptake and depuration by oysters after use of dispersants on a shallow water oil spill in El Salvador (see Box 5-3). Because the PAH levels dropped to nearly background within three weeks after application of dispersant, the authors concluded that the subtidal sediments in the spill site did not contain residual oil and therefore did not constitute a continuing source of oil to coastal resources. Studies in which the sediments were a major reservoir for spilled oil have reported elevated levels of PAH in oysters for months to years after the spill (Neff and Haensly, 1982; Blumer et al., 1970). Because most of the oil in the El Salvador spill was dispersed there was no opportunity to compare uptake and depuration of dispersed oil versus untreated oil. Thus, it was not possible to determine if the use of dispersants increased the amount of oil that reached benthic habitats. However, a qualitative comparison of PAH measurements in oysters collected during other oil spills where dispersants were not applied, does not suggest any dramatic difference in uptake (Michel and Henry, 1997). The SERF in Corpus Christi, Texas, was used in a series of mesocosm experiments to evaluate the ecological effects of shorelines impacted by oil and chemically dispersed oil (Coelho et al., 1999; Fuller et al., 1999; Bragin et al., 1999). Simulated beaches were constructed in experimental wave tanks (described in detail in Chapter 3) with fine sand. Treatments included artificially weathered Arabian medium crude oil, oil premixed with Corexit 9500, and controls. Six liters of oil or oil-dispersant mixture were poured onto the surface of

the tanks. After an initial mixing period of one hour, fresh sea water was circulated continuously through the wave tanks to simulate tides with a 12-hour period. A variety of organisms (fiddler crabs, polychaete worms, amphipods, fish, and oysters) were exposed *in situ* in the wave-tank mesocosms or *ex-situ* in laboratory toxicity tests. In the oil-only treatment, the TPH concentrations in water peaked at 15,360 μg/L at 6 hr and then declined to a concentration of 2,948 μg/L at 24 hr (Coelho et al., 1999). The resulting total PAH concentrations in fish (*Cyprinodon variegatus*) and oysters (*Crassostrea virginica*) in the wave tanks at 24 hr were 8,420 and 8,590 μg/g, respectively. In the dispersed oil treatment, the TPH concentrations in water peaked at one hour at 48,580 μg/L and declined to 5,258 μg/L after 24 hr. The total PAH concentrations in fish and oysters were 18,440 and 3,550 μg/g, respectively after 24 hr. The similarity in PAH concentrations in oysters under the two treatments may be related to the oil-only exposure being limited to certain phases of the tidal cycle. As has been documented in field studies, sediment concentrations of TPH in the dispersed oil treatments were very low compared to the oil-only treatment, a consequence of the untreated oil becoming trapped in the mesocosm wave tank (Coelho et al., 1999). Interpretation of toxicological evaluations was confounded, in some instances, by unacceptable control mortality. However, in general, results suggested comparable toxicity of chemically and physically dispersed oil in these mesocosm experiments (Fuller et al., 1999; Bragin et al., 1999).

In general, the available information from field and mesocosm studies seems to indicate that dispersants will reduce the persistence of oil in subtidal and intertidal sediments compared to untreated oil. Consequently, there may be a trade-off between short-term acute effects due to increased concentrations of petroleum hydrocarbons in the water column countered by the reduction in long-term chronic exposure to petroleum hydrocarbons from stranded oil. However, this conclusion is based on limited information, and the interactions between dispersed oil and sediments are still poorly understood. For example, Ho et al. (1999) found that toxicity of sediments in the vicinity of the *North Cape* spill (a spill that had incredibly high physical dispersion of home heating oil) lasted for more than 6 months in some areas. Sediments in this study were fine grained, unlike those in the SERF mesocosms that were sandy. Consequently, a focused series of experiments should be conducted to quantify the final fate of chemically dispersed oil droplets compared to undispersed oil, including an evaluation of the interaction with a broader range of sediment types.

BOX 5-3
Case Study: Acajutla, El Salvador

Spilled Oil Type/Volume/Conditions. An estimated 400 ± 100 barrels of a blended crude oil called Venezuela Recon was released about 1 km offshore at the mooring buoy off the Refineria de Acajutla, El Salvador on 23 June 1994. Venezuela Recon is a 50:50 blend of a heavy Venezuelan crude and light, intermediate products such as naphtha and gas oil. It appeared much like a black diesel. Properties were: API gravity of 34.9; viscosity of 4.38 cSt; and pour point of –15°C. It would be readily dispersible.

Physical and Biological Setting. The spill affected open, exposed coastline consisting of rocky shores and sand beaches. Water depths were 4–6 m over mixed sand and rock bottom. Winds were high during the spill, but calm during dispersant applications over the next few days. There are inshore fisheries both for finfish (by boat) and for benthic oysters attached to rock outcrops (by free diving).

Dispersant Application. Thirty barrels of Corexit 9527 were applied over a 3-day period, for an application rate of 1:13. Applications followed guidelines in the facility's oil spill contingency plan. Dispersant was first applied on 24 June within 12–15 hr after the spill by fixed wing aircraft and workboats. Some Corexit 7664 was applied from shore to oil in the surf zone. Small nearshore slicks were treated with Corexit 9527 sprayed by workboats for two more days. On the morning of 27 June, no visible slicks were reported.

Wildlife

One of the widely held assumptions concerning the use of dispersants is that chemically dispersion of oil will dramatically reduce the impacts to seabirds and aquatic mammals, primarily by reducing their exposure to petroleum hydrocarbons (e.g., French-McCay, 2004). Evaluating the validity of this assumption is critical because it is often a key factor in the decision on whether or not to use dispersants on a particular spill. Unfortunately, little is known about the effects of dispersed oil on wildlife, especially aquatic mammals. Oil can affect wildlife through a combination of effects: toxicity due to ingestion of oil or contaminated prey; inhalation of petroleum vapors; and loss of thermoregulatory capacity due to physical oiling of feathers and fur. In addition, adults that become oiled may transfer oil from their plumage to their more sensitive eggs or

Monitoring Results. *Effectiveness:* Monitors conducting visual observations during overflights reported that the application was highly effective. The small amount of oil that stranded onshore was removed manually. *Effects:* Because of concern over potential impacts of the spill and dispersant use on fisheries, a monitoring plan was developed. Fishermen were queried to determine if they had encountered any oil on their nets or catch or any dead organisms. No encounters were reported. Commercial fishermen were hired to free-dive for oysters at four locations (included two background locations). Whole oysters (including the gut) were analyzed for PAH to fingerprint the oil and monitor for the presence and bioavailability of oil to benthic resources at 7, 28, 185, and 280 days post-spill (though there was another small spill reported just prior to the 185 day sampling event).

Two samples of oysters from the area where the oil was dispersed in 4–6 m of water contained total PAH of 147 and 164 ppm, dry weight, compared to background levels less than 1.0 ppm. The PAH patterns indicated that the oil in the oysters was slightly weathered whole oil. Since the oysters had been exposed to clean water for at least five days, it is likely that they were already depurating the oil and the oil measured represents a body burden rather than oil in the digestive glands. Four weeks post-spill, PAH levels in oysters from these areas decreased by 94–98 percent. Half-lives for 2- and 3-ringed PAH were calculated to range from 2.8 to 4.7 days, and 4- to 6-ringed PAH ranged from 3.7 to 30 days. These values were similar to results of laboratory studies. These studies showed that dispersed oil did reach benthic communities when dispersed in 4–6 m of water in open-water conditions. Uptake by oysters was rapid, and depuration was complete within 28 days.

SOURCE: Summary based on Michel and Henry (1997).

hatchlings—refined oil is highly toxic to avian embryos. The limited available information suggests comparable toxicity of dispersed and untreated oil to seabirds and mammals. A literature review by Peakall et al. (1987) concluded that, from the toxicological perspective, the effects of oil and chemically dispersed oil on seabirds were similar, based on sublethal responses at the biochemical and physiological level. Similarly, studies on the effects of oil on the hatching success of bird eggs (summarized in NRC, 1989) also indicated that toxicities of oil and dispersed oil were similar.

Hence, the main concern for the impacts of dispersed oil and dispersants is in the physical loss of insulative properties of the feathers and fur of wildlife when coated with oil, which in turn can lead to hypothermia, stress, starvation, and ultimately death of the animal. The effect of external oiling on the thermal insulation of plumage has been shown to be

dependent on the amount of water that is absorbed into the plumage as a function of the amount of oil exposure. Peakall et al. (1987) derived a mathematical model to estimate the amount of dispersed oil to which seabirds would be exposed. The risk of exposure to oil is dependent on the behavioral characteristics of birds. Because the purpose of dispersants is to drive oil into the water column, only those activities that cause seabirds to submerge, such as feeding, would lead to an increased exposure to oil. Based on their modeling analysis, Peakall et al. (1987) concluded that there is no significant exposure of birds to oil in the water column, rather, the highest exposure occurs when the bird dives or returns to the water-oil surface. They concluded that the assumption that dispersing oil benefits seabirds depends on the efficiency of the dispersion. However, several later evaluations have challenged this assumption, asserting that exposure to even small amounts of organic petroleum compounds and surfactants may result in adverse effects to birds and potentially bird populations (Jenssen, 1994; Briggs et al., 1996; Stephenson, 1997).

The waterproof properties of feathers and their value as thermal insulators are due to their composition and their structure. The keratin of feathers is inherently water repellant. In addition, the lattice structure and contour of feathers promote the shedding of water droplets from the surface of the feather (Stephenson, 1997). Thus, it is reasonable to predict that any factors that compromise the integrity of the plumage, such as exposure to oil or dispersants, will affect thermoregulation and result in a physiological cost to the animal. Similar effects would be expected in aquatic mammals, such as otters, that rely on water-repellant fur to maintain normal thermal regulation (Jenssen, 1994).

As noted previously, very few studies have evaluated the effects of dispersed oil on thermoregulation. Lambert et al. (1982) compared metabolic rates of mallards exposed to Prudhoe Bay crude oil and Corexit 9527. They found higher metabolic rates in birds exposed to dispersant, presumably due to increased energy expended to maintain a normal body temperature. Jenssen and Ekker (1991) reported that a much smaller volume of chemically treated oil compared to crude oil was required to cause significant effects on plumage insulation and thermoregulation in eiders. Because dispersants are surface active agents that reduce water surface tension, they may also increase the wettability of bird feathers and hence disrupt their insulation properties (Stephenson, 1997). Stephenson and Andrews (1997) concluded that adult bird feathers could be wetted when the surface tension of water is reduced below a certain threshold. In addition, Stephenson (1997) indicates that a multitude of surface-active organic contaminants, including petroleum compounds and detergents, may have detrimental effects on aquatic birds due to alterations in water surface tension. Application of chemical dispersants during an oil spill

may lower the amount of oil to which a bird or aquatic mammal is exposed while at the same time increasing the potential loss of the insulative properties of feathers or fur through reduction of surface tension at the feather/fur-water interface. Clearly, more studies are needed to address the uncertainties associated with the impacts of dispersants and dispersed oil on wildlife. A similar conclusion was also reached by NRC (1989), and very few studies have been conducted since that initial recommendation.

Microbial Communities

During the decision-making process an important factor to be considered is whether degradation of the spilled oil will be enhanced or inhibited using dispersants, thereby affecting the ultimate fate of the oil. As discussed in Chapter 4, there is no conclusive evidence demonstrating either the enhancement or the inhibition of microbial biodegradation when dispersants are used. Studies specifically addressing the toxic effects of dispersants or dispersed oil on microorganisms are limited and effects are often inferred from inhibited rates of oil biodegradation (see Chapter 4 and Table 5-9). To determine toxic effects to bacterial populations as a result of dispersant use, consideration should be given as to the transport mechanism involved for oil uptake by the particular species under study. Transport mechanisms include uptake from the dissolved phase or via a direct contact mechanism. Addition of dispersants can alter the concentration of dissolved phase hydrocarbons and interfere with normal bacteria-oil droplet attachment mechanisms (Zhang and Miller, 1994) as discussed in Chapter 4. These changes could result in enhanced or decreased exposure of the bacteria to particular hydrocarbons, which may be either advantageous or detrimental (toxic) to the microbe. There are few studies that directly examine routes of exposure and toxicity to microorganisms.

Inhibition of biodegradation rates may be caused by a variety of factors, including toxicity, though it could also result from the fact that the dispersant may substitute for the oil as the carbon source. However, it is also possible that an increased concentration of dispersed oil (or dispersant) could cause temporary toxic effects to natural microbial populations. Studies of biodegradation rates that report changes in bacterial growth (numbers) or uptake of glucose as indicators of toxic effects should be interpreted with caution. Many other factors could be limiting, such as nutrients and other growth factors. Extrapolating data from laboratory tests is difficult because hydrocarbon degradation rates are often several orders of magnitude higher compared with *in-situ* rates. Conversely, any toxic or inhibitory effects are also likely to be magnified in the laboratory setting (NRC, 1989).

Studies addressing specific toxicity issues in microbial communities are very limited, with the majority being an indirect observation from biodegradation studies using enhanced or inhibited growth of microbial populations. For example, Linden et al. (1987), in a microcosm system aimed at modeling the littoral ecosystem of the Baltic Sea, demonstrated elevated numbers of water-borne heterotrophic bacteria after 30 hr in dispersed oil treatments relative to oil alone. After 7 days post-exposure, the differences between treatments were not significant. This study indicates no toxic effect to the microbial population as a whole with the use of dispersants; however, growth as measured by bacterial counts may mask selective toxicity to some bacterial strains concordant with elevations in numbers of tolerant or specific hydrocarbon degrading strains. It should be noted that a 100-fold increase of C_{16}-specific organisms was observed after 30 hr in the dispersant-oil treatment compared with oil alone (Linden et al., 1987). A similar elevation in bacterial numbers in response to chemical (Corexit 9500) versus physical dispersion was observed by MacNaughton et al. (2003), again measured by total bacterial counts. Some dispersant studies have demonstrated that when microbial processes are inhibited, rates of oil decomposition decline (see Chapter 4; NRC, 1989; Mulyono et al., 1994; Varadaraj et al., 1995).

Although there are a few studies specifically on microbial toxicity, none examined natural marine microbial populations. George et al. (2001) indirectly addressed the toxicity of oil and oil plus dispersant treatments to microbes by determining effects on the intestinal flora of rats and the mutagenic potential of these mixtures using an assay on bacteria (see below). The reasoning behind this study was to determine the adverse health effects of cleanup options on marine mammals. It was hypothesized that even low levels of oil (with or without dispersant) may cause toxic effects following ingestion due to the alteration in gastrointestinal tract metabolic processes. The rat was used as a model organism to determine if co-administration of Corexit 9527 enhanced oil toxicity or mutagenicity. The study demonstrated that oil exposure reduced several cecal microflora populations (see Table 5-9 and 5-10), and Corexit alone reduced the lactose-fermenting enterobacteria Conversely, the oil plus dispersant treatment increased the lactose fermenting group with no changes in other bacterial populations. It should be noted that these data were derived from only three rats. In test treatments, the authors found that both dispersants (Corexit 9500 and 9527) were mutagenic in various strains of *Salmonella typhimurium* (employed for the Ames histidine reversion bioassay), using dilutions up to 1:1,000, but weathered Nigerian crude oil was not mutagenic. No data were available for the dispersed oil mixture. A similar study also found Corexit 9527 alone to be toxic in the Microtox assay with an EC_{20} of 1 ppm (Poremba and Gunkel, 1990). Although both studies

demonstrated the toxic effects of dispersant, dispersed oil was not investigated. Because these studies examined a single laboratory species exposed to relatively high levels of dispersant, the potential effects on natural mixed, marine bacterial populations cannot be assessed.

There are a multitude of implications regarding the effects of dispersant and dispersed oil on microbial communities. A lack of toxicity is often inferred in studies that show increases in numbers of bacteria. However, this may not accurately reflect the entire microbial community because elevations in some bacterial (tolerant) species may mask the inhibition (toxicity) of other types. A lack of inhibition observed at the community levels does not necessarily indicate the absence of toxicity. Elevated numbers of bacteria may also reflect an indirect enhancement if dispersant or dispersed oil is toxic to bacteriovores (Lee et al., 1985). The removal of the bacterial grazers would also cause elevated bacterial counts, although these would probably be temporary. Alterations in bacterial species composition may have severe consequences for the ecosystem as a whole. In addition, elevated numbers of bacteria may result in toxic effects to other forms of life. For example, elevated bacterial numbers may deplete oxygen levels in benthic substrates, resulting in indirect toxic effects to organisms inhabiting this environment. Additionally, some microbial pathways may lead to transformation of the oil into more toxic byproducts. The impact of dispersants and/or dispersed oil on gut microflora, particularly in relation to ingestion by marine mammals, has been discussed above. Because of their importance in aquatic systems, targeted toxicity studies should be conducted to address the effects of dispersant and dispersed oil on the composition and metabolic activities of mixed microbial populations representing marine (or estuarine/freshwater) communities.

Coral Reefs

Compared with other test species, data on the effects of dispersants and/or chemically dispersed oil and comparisons with physically dispersed oil on coral species are even more limited. The majority of research was conducted in the 1970s and 1980s, and these studies (field and laboratory based) have been adequately discussed and summarized in NRC (1989). Many of the early studies were conducted by researchers at the Bermuda Biological Station (e.g., Cook and Knap, 1983; Dodge et al., 1984, 1995; Knap, 1987; Knap et al., 1983, 1985; Wyers, 1985; Wyers et al., 1986) who conducted an extensive series of laboratory and field based studies on the effects of dispersants (e.g., Corexit 9527 and BP1100WD) and dispersed oil (Arabian light crude) on the brain coral *Diploria strigosa*. These studies were based on 6 to 24 hr exposures followed by recovery in clean seawater. They found no significant differences between the oil and the

TABLE 5-9 Detail of Studies Addressing Effects of Dispersant/Dispersed Oil on Microbial Populations

Microbial sps./Community	Dispersant/Oil (D:O ratio)	Metrics Used
Indigenous mixed microbial population	D; Corexit 8666, Gamlen Sea Clean, GH Woods degreaser, Formula 11470, Sugee 2 O; Arabian Crude (1:1)	Bacterial no. (growth; drop-plate method). Species diversity.
	D; Corexit 8666, Shell oil herder #3, Smith oil herder O; Crude oil	CO_2 evolution
Arthrobacter simplex *Candida tropicalis*	D; ONGC-1, ONGC-2, ONGC-3, ONGC-4 O; Saudi Arabian Crude, Bombay high crude (1:5)	Growth (turbidity)
Indigenous mixed bacterial population	D; IB 2/80, IB 1/80, IB 11/80, IB 12/80, IB 13/80, BP 1100WD, BP 1100 O; Saudi Arabian Crude (1:1)	Bacterial no. (spread plate method)
Mixed population	D; Corexit 9500 O; Forties crude (W), ANS (W) (1:10)	Bacterial no.
Mixed culture of oil degrading bacteria	D; 15 FW dispersants O; Newman-wells (D:O various)	Bacterial no.'s CO_2 evolution
Photobacterium phosphoreum	D; E09, DK50, DK 160 O; Ekofisk crude (± W) (1:100–10,000)	Microtox assay (loss of bacterial bioluminescence indicates toxicity)
Rat intestinal bacterial mixed population *Salmonella typhimimurium* (mutagenicity study)	D; Corexit 9527, Corexit 9500 O; Weathered Bonnie light Nigerian crude oil	Bacterial no.'s Species diversity Bacterial enzymes quantitation
Natural flora (from pond)	D; Corexit 9550 O; Forties North Sea (1:10)	No. heterotrophic bacteria, plus 4 specific-species counts
Acinetobacter calcoaceticus, *Photobacterium phosphoreum* and *Serratia marioruba* *P.phosphoreum* (microtox test)	D; Finasol OSR-5, Corexit 9527 (plus biosurfactants and other synthetic surfactants) O; none	Bacterial no.'s Bacterial bioluminescense (microtox test)
Natural flora (enclosed ecosystem—SEAFLUXES)	D; Corexit 9527 O; Prudhoe Bay Crude Oil (1:10) (No oil alone test)	Heterotrophic bacterial production (thymidine incorporation) Direct counts (epifluor. microscope) Bacterial biomass (electron micros.)

Finding	Reference
Increased no.'s with D alone Elevated no.'s in DO c.f. O alone Changes in species diversity with DO (genus level).	Mulkins-Phillips & Stewart, 1974
Increased CO_2 evolution in DO c.f. O	
D non-toxic (growth). Increased growth DO c.f. O alone	Bhosle & Mavinkurve, 1984
Only D toxic was IB 2/80. No difference in growth with D c.f. DO. O alone toxic.	Bhosle & Row, 1983
Bacterial no.'s increase with DO c.f. O (forties). ANS study, DO bacterial no.'s initial elevation (quick colonization), no difference c.f. O alone at later time-points	[a]MacNaughton et al., 2003
Changes in no.'s and species diversity is D dependent, some toxic, others no-effect or increase growth	[b]Foght et al., 1987
Decreased toxicity of DO c.f. O. High levels of D toxic.	[c]Poremba, 1993
Treatment changes in bacterial enzyme activities. Oil reduction of microflora in 3 populations; D alone 1 reduction and DO slight elevation (1 population) Species composition changes. D toxic to *S. typhimum* (O alone not).	George et al., 2001
30 hr-increase bacterial no.'s in DO c.f. O; no differences at 7 days C_{16}-organisms 100x in DO c.f. O, other species same	Linden et al., 1987
No inhibition of growth, some elevated. EC_{20} Corexit and Finasol at 1mg/L	[d]Poremba, 1993
Elevated bacterial production by D and highest in DO test. Toxicity to bacteriovors	Lee et al., 1985

continues

TABLE 5-9 Continued

Microbial sps./Community	Dispersant/Oil (D:O ratio)	Metrics Used
Soil bacteria; mixed microbial population	D; Corexit 9550 O; Arabian crude, Louisiana crude (1:5)	Gross metabolic capacity (CO_2, CH_4)
Pond natural bacterial population *Salmonella typhimimurium* (mutagenicity study) *Spirillum volutans* (toxicity test)	D; Corexit 9527 O; Fresh Norman Wells Crude	General biomass (microscope enumeration and ATP levels), heterotrophic plate count, MPN

NOTE: ANS, Alaskan North Slope crude oil; ATP, adenosine triphosphate; D, dispersant; DO, chemically dispersed oil; FW, freshwater; MPN, most probable numbers; O, oil; W, weathered.

[a]Biodegradation study with indirect toxicity observations.
[b]Freshwater study.

TABLE 5-10 *Cecal microflora* Effects Following 5 Weeks of Nigerian Crude Oil and Corexit 9527 Treatment of F344 Rats

Microflora Population	Selective Medium	Control[a]	Oil	Corexit	Oil + Corexit
Enterocci	KF	4.72	0.00[b]	4.90	4.74
Lactose-fermenting enterobacteria	MacConkey +	3.25	0.00[b]	2.59[b]	4.10[b]
Lactose-nonfermenting enterobacteria	MacConkey –	4.92	0.00[b]	4.71	4.90
Total anaerobic count	Blood agar	8.46	8.32	8.39	8.42
Obligately anaerobic Gram-negative rods	VK	8.19	8.12	8.13	8.24
Lactobactilli	Rogosa	7.73	7.81	7.78	7.64

[a]Male Fischer 344 rats were gavaged for 5 weeks with Nigerian crude oil (1:20) with and without Corexit 9527 (1:50). The cecum was removed from each animal, homogenized under CO_2, and diluted and plated anaerobically on selective media for enumeration. Results are an average from three rats.
[b]Significant at $p < 0.05$, one-way ANOVA.

SOURCE: modified from George et al., 2001.

Finding	Reference
No inhibition, some elevations (temporary)	[e]Nyman, 1999
No toxicity/mutagenicity of O or DO, slight short-term effects, i.e., O decreased no.'s but DO elevated no.'s (7 days)	Dutka & Kwan, 1984

[c]Dispersants alone.
[d]Using Microtox toxicity test bacteria.
[e]Soil study.

dispersed oil treatments using an array of biometrics including tentacle extension, mucus production, pigmentation loss, tissue swelling, and skeletal growth. Any stress effects were transient and recovery occurred within one week post-exposure. However, they did note reduced photosynthesis of the zooxanthellae (symbiotic algae) within the coral resulting from 8 hr exposure to 19 ppm dispersed oil, whereas this was not apparent in treatments with either oil or dispersant alone. Carbon fixation and lipid synthesis recovered to normal levels within 24 hr.

One of the more robust and extensive studies on early life stages of corals was undertaken by Negri and Heyward (2000). They exposed *Acropora millepora* eggs and sperm to WAF (heavy crude oil) and chemically dispersed oil (using Corexit 9527; dispersant to oil ratio at1:100 and 1:10) or dispersant alone for 4 hr and assessed fertilization rates. They found no inhibition of fertilization at >0.165 ppm THC in WAF exposures (>10 percent dilution of stock WAF) but significant inhibition for exposure to dispersed oil (1:10 DOR) at 0.0325 ppm (equal to a 1 percent dilution). Exposure concentrations were estimates based on measured concentrations of THC in the stock solutions used to make the dilutions. Dispersants alone resulted in significant inhibition (final dilution of 0.1 percent), although at a lower magnitude than dispersed oil at the same dispersant concentrations. Although fertilization in this species appeared to be relatively insensitive to naturally dispersed oil droplets, crude oil

and dispersant alone inhibited larval metamorphosis, with the greatest inhibition observed when larvae were exposed to chemically dispersed oil. Metamorphosis was inhibited at 0.0824 ppm THC and 0.0325 ppm THC for crude oil and chemically dispersed oil (1:10 DOR), respectively. The authors concluded that there may be additive toxicity of dispersants and oil and recommended that the timing of spawning events be considered in management decisions on dispersant use in coralline environments. However, as noted previously, without evaluation of specific chemical constituents in the various exposures regimes, conclusions regarding relative toxicity of chemically dispersed versus physically dispersed oil are tenuous.

A study by Epstein et al. (2000) investigated the toxicity of five third-generation dispersants to early life stages of coral. Planula larvae of stony coral (*Stylophora pistillata*) and soft coral (*Heteroxenia fuscesense*) were exposed to varying concentrations of WAF, chemically dispersed oil (1:10, DOR), and dispersants alone (0.5–500 ppm) using short-term (2–96 hr) bioassays. WAF treatments resulted in a concentration-dependent reduction in planulae settlement, but no mortality. All the tested dispersants also decreased settlement rates, even at the lowest tested concentrations (0.5 ppm). In addition, larval survival at 50 and 500 ppm after 96 hr was completely or significantly reduced in most of the dispersants tested. Chemically dispersed oil exposures resulted in a dramatic increase in acute toxicity to both coral species larvae. In addition, the authors reported that dispersants and dispersed oil treatments caused larval morphological deformations, loss of normal swimming behavior, and rapid tissue degeneration. Interpretations of physically versus chemically dispersed oil toxicities in this study are hampered by the use of nominal exposures.

A recent study investigating the effects of dispersant and dispersed oil by Shafir et al. (2003) using coral nubbins of the hard coral *Stylophora pistillata* exposed to water-soluble fractions (WSF), dispersant, and chemically dispersed oil for 24 hr (static exposures) followed by recovery for long-term assessments in clean seawater. No mortality was observed at any of the WSF concentrations, but extensive mortality was observed with dispersant alone (at 24 hr all doses including 1 percent stock dilution) with a delayed enhanced mortality occurring at the 0.1 percent concentration after 6 days. Survivorship of chemically dispersed oil exposed corals was similar to that described for dispersant alone.

The Tropical Oil Pollution Investigations in Coastal Systems (TROPICS) field experiments are particularly useful in evaluating the impacts and trade-offs of dispersants and dispersed oil on corals, seagrasses, and mangroves (Ballou et al., 1987, 1989; Dodge et al., 1995). In these field experiments in Panama, corals were exposed to oil and chemically dispersed oil for relatively short periods (1–5 days) followed by extensive

monitoring for 1–10 years post-exposure (see Box 5-4). Sites were monitored repeatedly in the first two years, and at two later dates (ten years final). At the untreated oil site no significant impacts to corals were observed at any of the time points (Dodge et al., 1995). At the dispersed oil site, corals were exposed to higher concentrations of oil (i.e., 24 hr averages of 5.1 ppm vs. 0.14 ppm at the untreated oil site). Significant impacts to the coral reef were observed and at two-years post-exposure these included reduced coral coverage and reduced growth in two hard coral species (*Agaricia tennuifolia* and *Porites porites*) with no reduction in two other species (*Montastrea annularis* and *Acropora cervicornis*). However, at the 10 year monitoring time point, recovery was complete and comparable to pre-spill conditions and conditions at the control site (Dodge et al., 1995).

Another field experiment using two oil exposure regimes was conducted in the Arabian Gulf by LeGore et al. (1983, 1989). Exposures consisted of oil alone (Arabian light crude), dispersant alone (Corexit 9527), and oil/dispersant mixtures with analysis of water chemistry. The two series of experiments consisted of a 24 hr or 5 day (120 hr) exposure period. The authors concluded that coral growth appeared to be unaffected by exposure to the toxicants, although some *Acropora* sp. exposed to the dispersed oil for 5 days did exhibit delayed, but minor effects, that became apparent only during the relatively cold and stressful winter season.

Corals are particularly susceptible to PAH dissolved in seawater or adsorbed to particles because the layer of tissue covering the coral skeleton is thin (approximately 100 μm; Peters et al., 1997). Also, coral tissue is rich in lipids (high lipid/protein ratios), facilitating the direct uptake and bioaccumulation of lipophilic chemicals, including PAH found in oil (Peters et al., 1981). Indeed, it has been observed that oil is quickly and readily bioaccumulated in coral tissues and is slow to depurate, possibly reflecting inefficient contaminant metabolism or lack of detoxification pathways (see Shigenaka, 2001). Long residence times of PAH were indicated by high PAH concentrations found in oiled corals (up to 50 mg hydrocarbon g lipid^{-1}) from Panama as long as 5 months after the original spill (Burns and Knap, 1989). A laboratory study by Kennedy et al. (1992) demonstrated a linear uptake rate of benzo(a)pyrene in corals and their zooxanthellae. Accumulated levels were slowly eliminated with 38–65 percent of the accumulated benzo(a)pyrene remaining after 144 hr depuration (recovery) in clean seawater (Kennedy et al., 1992). This rapid uptake and slow depuration may be of particular relevance to oil toxicity mechanisms in corals. Many studies have shown that a brief exposure to oil may not result in immediate death to coral species (acute oil toxicity), but induces mortality over an extended period of time (delayed effects) (see Shigenaka, 2001 for a summary). On a similar theme, Fucik et al. (1984) suggested that acute toxicity is probably not a good indicator of oil impact, stating

that it is much more likely that adverse effects to coral species would be manifested at sublethal levels.

One relatively unstudied hypothesis that could explain delayed effects is that most of the toxicity is derived from exposure to the UV radiation in sunlight (see earlier section on Phototoxicity in this chapter). This phenomenon may be of particular relevance in explaining the high toxicity of accumulated oil in corals, species that are slow to depurate PAH.

BOX 5-4
Case Study: TROPICS, Panama

Spilled Oil Type/Volume/Conditions. In 1984, a field oil experiment called the Tropical Oil Pollution Investigations in Coastal Systems (TROPICS) was conducted in Panama. The objective of the TROPICS experiment was to evaluate the relative impacts of oil and dispersed oil on mangroves, seagrasses, and corals. Exposure concentrations were targeted to be as high as 50 ppm, in a worst-case scenario, with dispersants applied to oil directly over corals.

Physical and Biological Setting. Sheltered shallow area near Bocas del Toro, Panama (Figures 5-7 and 5-8). Mature mangroves with extensive seagrass beds (water depth average about 40 cm), and coral reefs (water depth average 60 cm).

Oil and Dispersed Oil Application. The oil, or dispersed oil, was applied inside boomed areas 30 m wide and 30 m deep, extending across all three habitats. The pre-mixed dispersed oil (4.5 barrels) was released over a 24-hour period so that the dispersed oil concentrations would stay elevated over the exposure period. The untreated whole oil (6 barrels) was released in two periods over the 24 hr, at an application rate of 1 liter/m^2. After one more day, the remaining floating oil was removed with sorbents.

Monitoring Results. *Water Column Monitoring:* Oil concentrations at each treatment site (oil or dispersed oil) were monitored continuously for 24 hr using a field fluorometer that was calibrated to convert fluorescence into the concentration of physically and chemically dispersed oil. Discrete and unfiltered water samples were collected for chemical analysis by gas chromatography (GC). In comparing the oil concentrations in the water as measured by both approaches, the field fluorometer readings were 3 times higher that the GC concentration for samples from the dispersed oil site, and they were 17 times higher than the samples from the undispersed oil site. Therefore, the oil concentrations as measured in the discrete water samples by GC were used to calculate the oil exposures because these results are more quantitative.

Not only are corals in high-light environments, they are translucent and seek high intensity light environments (by regulating pigments or altering their position with respect to the sun) to foster the symbiotic relationship with photosynthetic algae.

An additional stress for corals may be attributed to the physical toxicity of oil droplets. It has been observed that oil droplets adhere to the surface of the coral, which results in a complete breakdown of the under-

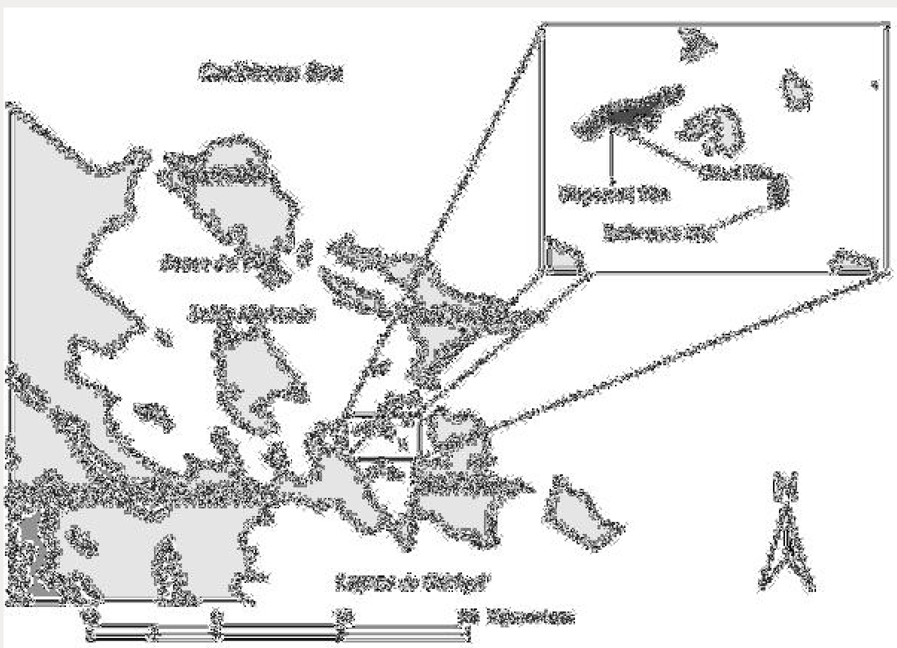


FIGURE 5-7 Case study: (TROPICS, Panama) Map of TROPICS study sites near Bocas del Toro, Panama.
SOURCE: Ward et al., 2003; courtesy of the American Petroleum Institute.

Effects: The sites were monitored five times in the first two years and once in 1994, ten years later. At the oil-only site, the corals were exposed to a 24-hour average of 0.14 ppm and a 48-hour average of 0.14 ppm. No significant impacts to corals were observed during any monitoring period.

At the dispersed oil site, the corals were exposed to a 24-hour average of 5.1 ppm (with a 1 hr maximum of 14.8 ppm) and 1.6 ppm at 48 hr. The average exposure over the 48-hour period was 3.4 ppm. At these expo-

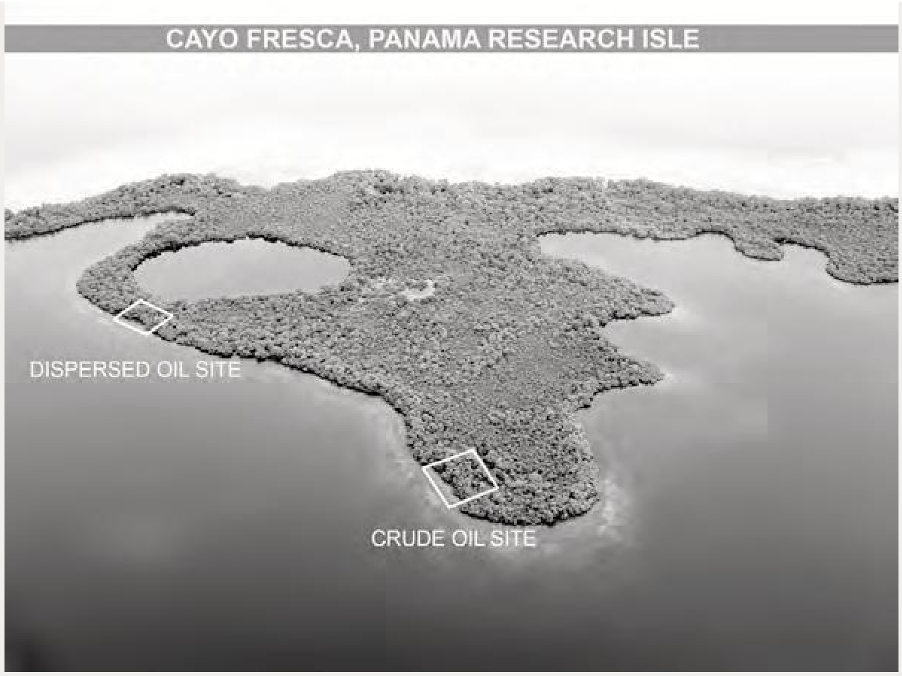


FIGURE 5-8 Case study: (TROPICS, Panama) Aerial view of whole oil and dispersed oil sites.
SOURCE: Coastal Science Associates, Southern Affiliate, Incorporated.

sures, there were significant impacts to the shallow coral reef communities. Impacts observed at two years post-exposure included: reduced coverage by the major categories of all organisms (30 percent), hard corals (10 percent), all animals (30 percent), and plants (10 percent); reduced growth of the two most important hard coral species (*Agaricia tennuifolia* and *Porites porites*) but not two others (*Montastrea annularis* and *Acropora cervicornis*); and mortality of binding sponges. Studies conducted ten years post-exposure showed full recovery of coral coverage to levels equal those present pre-spill at the dispersed site and equal to conditions at the non-oiled control site.

Dispersed oil concentrations over the shallower seagrass (*Thalassia testudinum*) habitat were five times higher than over the coral habitat, av-

lying tissues (Johannes, 1975). Again this phenomenon may be of direct relevance in interpreting physically versus chemically dispersed oil toxicities. NRC (1989) stated that the smaller droplets in chemically dispersed oil did not adhere to the corals, in contrast to the larger, physically dispersed oil droplets, some of which were found on coral a few weeks after

eraging 22 ppm over 24 hr with a maximum of 70 ppm as measured in discrete water samples analyzed by GC. Even at these high exposures (the maximum likely oil concentrations), no negative effects were observed for plant survival, growth rates, or leaf blade area at the dispersed oil treatment site compared to the non-oiled reference site.

Untreated, whole oil caused significant impacts to mangrove habitats with high levels of defoliation and 17 percent mortality of adult mangroves after 2 years. After 10 years, mangrove mortality increased to 46 percent and some subsidence of the sediment surface was observed at the oiled site. After 18 years, the oiled site started to show some recovery as new trees replaced the dead trees (Figure 5-9; Ward et al., 2003). This field experiment clearly demonstrates the trade-offs associated with dispersant use in shallow tropical settings.

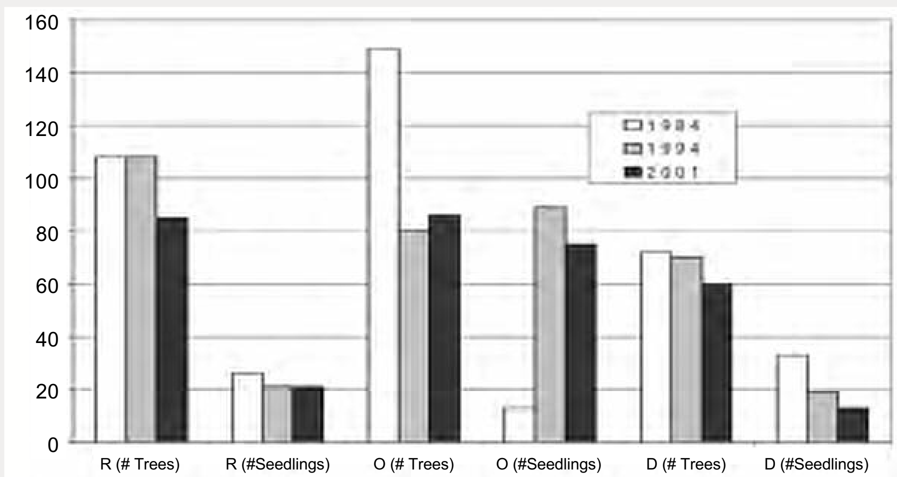


FIGURE 5-9 Results of 18 years of monitoring impacts to mangroves in Panama as part of TROPICS. Histograms reflect mangrove tree or seedling population counts (1984–2001) from whole oil (Site O) and dispersed oil (Site D) compared to a reference site (Site R). SOURCE: Ward et al., 2003; courtesy of the American Petroleum Institute.

SOURCE: Summary compiled from Ballou et al. (1987), Dodge et al. (1995), and Ward et al. (2003).

exposure to oil. In addition, a common stress response to oil pollution that has repeatedly been observed in coral species is the excessive production of mucus (see Shigenaka, 2001). This protective response can reduce the bioaccumulation of chemical contaminants by binding them in this lipid-rich mucus matrix that is ultimately "sloughed off" (or eaten by grazing

fish) the surface of the coral, so protecting the underlying tissues. It is unclear whether chemically dispersed droplets or physically dispersed droplets or accumulation of dissolved components could alter this response. The excessive production of mucus takes energy away from normal cellular processes potentially reducing the overall health and fitness of the coral. In the case of chronic oil pollution events, such as continued leaching from mangrove sediments, excess mucus production could ultimately lead to coral death.

In conclusion, recent studies of coral larvae clearly demonstrate impacts of dispersants and dispersed oil on corals and, because of their life history and habitat characteristics, these species may be especially susceptible (Table 5-11). Consequently, decisions concerning dispersant use should take coral toxicity studies into consideration. In addition, laboratory studies are needed to estimate the relative contribution of dissolved- and particulate-phase oil to toxicity in representative coral species. Because corals typically experience high levels of natural sunlight, these toxicity tests should include an evaluation of delayed effects and photo-enhanced toxicity.

Mangroves

Few reports have been published that address the use of dispersants in treating oil spills close to mangroves. Early work by Getter and Ballou (1985) used an experimental spill at a site in Panama and concluded that dispersant use reduced the overall impact of oil on mangroves. This was a long-term project (10 years), but lacked replication of study sites (Dodge et al., 1995). In order to investigate the types of oil spill responses that might reduce the impact of oil spills and to address the need for more relevant information on the effects of oil spills on mangroves, Duke, Burns and co-workers carried out a number of field trials to assess the benefits of two remediation strategies for mangrove forests (see Burns et al., 1999; Duke and Burns, 1999; Duke et al., 1998a,b,c, 1999, 2000). These experiments were aimed at bridging the gap between surveys of real spill incidents (e.g., Volkman et al., 1994; Duke et al., 1997, 1998c) and those obtained from seedling laboratory experiments (Lai and Lim, 1984; Wardrup, 1987; Duke et al., 1998a). Field experiments, named the Gladstone trials, investigated the effects of different oils and remediation strategies on mangroves over both short and long-term time scales (1995–1998) utilizing a variety of replicated trials. One study compared the effects of dispersant (Corexit 9527) or bioremediation (aeration plus nutrients) strategies on a controlled spill using pre-weathered (24 hr) Gippsland light crude oil. It should be noted that the dispersant Corexit 9527 was premixed and weathered with the oil mixture before application. There were

no differences observed between oil alone and dispersed oil treatments on resident fauna. Death of mangrove trees, however, was significantly lower in the plots treated with dispersant, similar to data previously obtained from laboratory and field studies (Duke et al., 1998a,c; Duke and Burns, 1999). With oil alone, long-term impacts on the fauna and little sign of recovery of trees led the authors to conclude that dispersion of spilled oil before it reaches mangroves should be considered for reducing the long-term impact of oil on mangrove habitat. It was interesting to note that the use of Corexit 9527 resulted in no difference in the amount of oil absorbed by the sediments, the penetration of oil to depth, or the weathering patterns of the oil over time.

IMPROVING THE USE OF INFORMATION ABOUT EFFECTS IN DECISIONMAKING

As discussed in Chapter 2, the ultimate decision regarding the use of dispersants in spill response generally rests upon answering the question as to whether use of dispersants will reduce the overall impact (Figure 2-4 in Chapter 2) by reducing the effects on some specific and sensitive species or habitat, without causing unacceptable harm to another specific and sensitive species or habitat. This decision represents a trade-off that will be dictated by a range of ecological, social, and economic values associated with the potentially affected resources. When spills occur offshore, where the potential magnitude and duration of impacts on organisms in the water column or seafloor can be assumed to be minimal, a decision to use dispersant can be made with information that is generally available. As the capability to deploy dispersants offshore increases, however, the capability to use dispersants in nearshore and shallower water settings will also increase. At the present time, the current understanding of the risk of dispersant use to shallow water or benthic species during a given spill is typically not adequate to allow rapid and confident decisionmaking. Several factors contribute to this uncertainty.

The rate of processes controlling the ultimate fate of dispersed oil is poorly understood. Of particular concern is the fate of dispersed oil in areas with high suspended solids and areas of low flushing rates. There is insufficient information to determine how chemically dispersed oil interacts with suspended sediments, as well as biotic components of aquatic systems, both short- and long-term, compared to naturally dispersed oil. **Relevant state and federal agencies, industry, and appropriate international partners should develop and implement a focused series of experiments to quantify the weathering rates and final fate of chemically dispersed oil droplets compared to undispersed oil.** Results from these experiments could be integrated with results from biological exposures

TABLE 5-11 Toxicity Studies of Chemically Dispersed Oil (or Dispersant Alone) to Coral Species in Laboratory and Field Studies (since 1988)

Species	Oil (D:O ratio)	Dispersant	Exposure
Coral reef (primarily *Porites porites* and *Agaricia tennuifolia*)	PBCO (1:20)	Commercial nonionic glycol ether-based	24 hr continuous release
Acropora spp. (growth), variety of corals visually assessed	Arabian light crude (1:20)	Corexit 9527	24 hr and 120 hr exposures plus 1 year recovery. Growth assessed.
Acropora palmata, Montastrea annularis, Porites porites	Oil (W) not detailed (1:10)	12 D including Corexit 9527, Corexit 9550, Finasol OSR7	DO and O, 6–10 hr, 2 week recovery and delayed assessments in clean SW.
Larvae of *Stylophora pistillata* and *Heteroxenia fuscescense*	Egyptian crude (1:10)	Inipol IP-90, Petrotech PTI-25, Biosolve, Bioreico R-93, Emulgal C-100	WSF (of O), DO WAF and D (5–500 ppm). 2–96 hr, static
Acropora millepora (eggs and larvae)	Heavy crude oil (1:10/100)	Corexit 9527	WAF, DO and D alone. Exposures; 4 hr fertilization assays (FA), 24 hr larval metamorphosis assay (LM); static
Stylophora pistillata (adult)	Egyptian crude (1:10)	Emulgal C-100	WSF (of O), D and DO WAF. 24 hr, static with recovery in clean SW.

NOTE: D, dispersant; DO, chemically dispersed oil; D:O, dispersant:oil ratio; HC, Hydrocarbon concentration (ppb); O, oil; PBCO, Prudhoe Bay Crude Oil; SW, seawater; TPH, total petroleum hydrocarbons; WAF, water-accommodated fraction; WSF, water soluble fraction.

comparing uptake of dissolved, colloidal, and particulate oil to provide a comprehensive model of the fate of dispersed oil in aquatic systems.

There is insufficient understanding of the actual concentrations and temporal/spatial distributions and behavior of chemically dispersed oil from field settings (from either controlled experiments or actual spills). Data from field studies (both with and without dispersants) are needed to validate models, provide real-world data to improve knowledge of oil fate and effects, and fulfill other information needs. **Relevant state and federal agencies, industry, and appropriate international partners should develop and implement steps to ensure that future wave-tank or spill-of-opportunity studies (or during the Natural Resource Damage**

Response	Comments	Reference
DO decrease in coral cover—complete elimination of *A. tennuifolia.*	Continuous field measurement of TPH and C_1-C_{10} hydrocarbons	[a]Ballou et al., 1989
Delayed sublethal impacts in all plots (bleaching); DO 120 hr exposure plots recovery less. No difference in growth rates.	HC concentrations measured over time (to 120 hr)	[a]Legore et al., 1989
Mortality was D dependent.	Nominal exposures	Thorhaug et al., 1989
Varied with exposure—from unsuccessful larval settlement to death. D toxic, DO WAF more toxic cf. WSF (and D alone).	Nominal exposures (dilutions of stocks)	Epstein et al., 2000
FA; WAF no effect. DO slight more toxic c.f. D alone. LM; DO more toxic cf. WAF, D toxic but at higher levels cf. [D] in DO.	Measured THC mg/L in stocks. Nominal concentrations calculated for dilutions.	Negri and Heyward, 2000
No death in WSF. D alone (1% or >) very toxic within 24 hr, delayed death (day 6) at 0.1%. DO WAF similar to D alone.	Nominal exposures (dilutions of stocks)	Shafir et al., 2003

[a]Field study.

Assessment investigations of oil spills that are not treated with dispersants) implement a field program to measure both dissolved-phase PAH and particulate/oil-droplet phase PAH concentrations for comparison to PAH thresholds measured in toxicity tests and predicted by computer models for oil spill fate and behavior. Accomplishing this will require the development and implementation of detailed plans (including preposition of sufficient equipment and human resources) for rapid deployment of a well-designed monitoring plan for actual dispersant applications in the United States. The RRT Region 6 Spill of Opportunity Monitoring Plan for dispersant application in the Gulf of Mexico should be finalized and implemented at the appropriate time. In addition, con-

sideration should be given to long-term monitoring of sensitive habitats and species (e.g., mangroves, corals, sea grasses) after dispersant application to assess chronic effects and long-term recovery. These data will be valuable in validating the assumptions associated with environmental trade-offs of using dispersants.

One of the widely held assumptions concerning the use of dispersants is that chemical dispersion of oil will dramatically reduce the impacts of oil to seabirds and aquatic mammals, primarily by reducing their exposure to petroleum hydrocarbons. Evaluating the validity of this assumption is critical, because it is often a key factor in the decision on whether or not to use dispersants on a particular spill (e.g., in the ecological risk assessment workshop analyses). In addition, populations of waterfowl and some aquatic mammals may be higher in nearshore and estuarine areas; therefore, validating this assumption becomes even more important. Unfortunately, there is very little available information on the effects of dispersed oil on wildlife, especially aquatic mammals. Of additional concern is the effect of dispersed oil and dispersants on the waterproof properties of feathers and their role as thermal insulators. One of the recommendations of the NRC (1989) report was that **studies be undertaken "to assess the ability of fur and feathers to maintain the water-repellency critical for thermal insulation under dispersed oil exposure conditions comparable to those expected in the field."** This recommendation is reaffirmed because of the importance of this assumption in evaluating the environmental trade-offs associated with the use of oil dispersants in nearshore and estuarine systems and because it has not been adequately addressed.

The primary assumption for models predicting acute toxicity of physically and chemically dispersed oil is additive effects of dissolved-phase aromatic hydrocarbons. However, the possibility of photoenhanced toxicity and particulate/oil droplet phase exposure is generally not considered. A number of laboratory studies have indicated toxicity due to PAH increases significantly (from 12 to 50,000 times) for sensitive species in exposures conducted under ultraviolet light (representative of natural sunlight), compared to those conducted under the more traditional laboratory conditions of fluorescent lights. In addition, the toxicity tests typically do not consider delayed acute or sublethal effects. Consequently, current testing protocols may significantly underestimate toxicity for some species. For example, corals appear to be particularly sensitive to dispersants and dispersed oil due to the potential for photoenhanced toxicity and delayed effects. Similarly, toxicological effects due to increased exposure to oil from smothering, ingestion, or enhanced uptake are not explicitly considered in exposure models. Better understanding of these variables will decrease the uncertainty associated with predicting ecological effects of dispersed oil. **Relevant state and federal agencies, industry,**

and appropriate international partners should develop and implement a series of focused toxicity studies to: (1) provide data that can be used to parameterize models to predict photoenhanced toxicity; (2) estimate the relative contribution of dissolved and particulate oil phases to toxicity with representative species, including sensitive species and life stages; and (3) expand toxicity tests to include an evaluation of delayed effects. Detailed chemical analyses should accompany these tests, including characterization of dissolved and particulate oil composition and concentrations, as well as bioaccumulation. By refining our understanding of these variables, and incorporating them into decision-making tools, such as fate and effects models and risk rankings, the ability of decisionmakers to estimate the impacts of dispersants on aquatic organisms will be enhanced.

NOAA representatives to the fisheries and water/chemistry technical working groups have been actively discussing the potential of the SIPPER (Shadowed Image Particle Profiling and Evaluation Recorder) system, used in conjunction with standard SEAMAP sampling, as a means of assessing characteristics of the rising oil plume and several categories of injury to the offshore system. Technical concerns regarding the capability of this combined sampling platform appear to have been resolved to the satisfaction of NOAA representatives to these technical groups, and NOAA technical representatives are seeking co-Trustee and management authority to proceed cooperatively with the RP and its representatives to develop a formal cruise plan, QA/QC plan, and data/sample handling plan for deployment of this integrated sampling approach within the next couple of days.

SIPPER is an *in-situ* suspended particle imaging system capable of collecting high resolution information on the distribution of zooplankton, phytoplankton, larval fish and detritus, and can provide data on oil droplet size distribution in the surface portion of the rising plume. It uses a high speed line scan camera to continuously image a 100 cm^2 sampling area as it moves through the water. This portable system is mounted on a small 5′×3′×2′ towed body that contains a conductivity, temperature and depth probe, a chlorophyll fluorometer, turbidity sensor and a transmissometer. Given the logistical constraints of sampling large areas using nets (i.e., SEAMAP protocols), and the large spatial variability in 3d (as well as variation on a daily cycle, as some species vertically migrate in and out of the surface layer on a daily basis), the SIPPER technology allows comprehensive sampling in space (horizontally and vertically), which can be ground-truthed with the SEAMAP samples. Image analysis of plankton has been developed over some 20 yrs now and is used in many plankton studies (as documented in the peer-reviewed literature). The continuous sampling makes the SIPPER uniquely efficient. Thus, with the SIPPER we can greatly expand the data set obtained by the nets. The system is towed through the water at speeds between 1-4 knots and can sample down to depths of 350 m. A comprehensive analysis software package is then used to extract, size, classify and manage the image and environmental data.

NOAA technical staff anticipate that this sampling regime will resolve questions regarding oil droplet size and contribute significantly to understanding water column injury. This will support calculations of dissolution rate (a function of droplet size) and so toxicity of the plume.

Depending on the assumptions made about release rate and the rise rate of the oil, the dimensions of the rising toxic plume are the order of 2km^2 to 15 km^2 near the water surface. Thus, a water column injury from deepwater to surface in a cylinder defined by a circle of this area and a height of the entire water column (1600m could be on the order of 3 – 24 billion m^3. The exposed volume will be replaced continually with new water (with newly exposed biota) as the currents flow past the release site. If dispersants are added at the source of the leak, the plume at depth will be larger and more toxic.

Floating oil will also entrain into the water when winds exceed 12 kts, and some toxicity likely exists in the surface mixed layer. This will be enhanced by the dispersant

applications, to the extent these are effective. However, as the oil weathers, the (acutely) toxic components will evaporate off the surface and so there is less chance of this water column injury with distance from the source.

The combined sampling should help quantify neuston exposures to toxicity from the release. This includes many species of fish eggs and larvae, decapod larvae, and other invertebrates. Not only would neuston be exposed to the oil on the surface (and entraining with wave action), but any PAH exposure there would be enhanced by phototoxicity (UV light, which is high at this latitude near the water surface). NOAA can model the concentrations of exposure and dose (assuming a spill rate and droplet size distribution), and so toxicity. However, densities of biota are required to quantify the injury. The most exposed biota are then: neuston, ichthyoplankton, and pelagic fishes occupying the surface mixed layer. The NMFS SEAMAP cruises have sampled neuston and ichthyoplankton in the area of concern only since 2008. Also, these plankton have highly variable densities over time and space. NOAA does not have data that can identify on surface pelagic fish densities, or any of the decapod larvae in the pelagic area affected.

Taking neuston and ichthyoplankton samples using SEAMAP protocols in 2010 May will be very important. If the spill continues into June and July, the species distributions and densities of those groups will change considerably. Thus, monthly sampling is indicated and important.

NOAA also has not identified any density data for fish or invertebrates in mid or deep water depths. As much of the rising toxic plume volume is in deep water, we will need to address this with sampling and/or other sources of information not yet identified. NOAA continues to research available data available for model inputs. NMFS SEFC notes that sperm whales use the spill area in spring to feed on giant squid at depth. This should be considered, particularly if a large amount of dispersant is injected at the leak such that much of the oil is dispersed at depth.

Pending management and RP approval, Trustees will coordinate with RP technical representatives to initiate an initial 10-day deployment beginning 5-4 or 5-5 from ST. Petersburg, FL. The three primary objectives of this deployment will be to better characterize NMFS statistical zones 8 & 9; undertake targeted sampling the area southeast of the wellhead (upstream water that will move through the plume); and to sample the plume itself, pending authorization from appropriate officials to enter the area with sampling equipment.

GulfofMexicoSPU

bp

MC-252 Incident
SIMOPS Plan

1	4/29/2010	Final – Issued for Use	Geir Karlsen	Houston Incident Commander
0	4/28/2010	Final – Issued for Comments	Geir Karlsen	Houston Incident Commander
Rev	**Date**	**Document Status**	**Custodian/Owner**	**Authority**

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AMENDMENT RECORD

Revision Number	Amender Initials	Date	Amendment
A	G. Karlsen	April 24, 2010	Initial draft.
B	K. Mouton	April 25,2010	Edits
C	G. Karlsen	April 27, 2010	Comments incorporated.
0	G. Karlsen	April 28, 2010	Comments incorporated, issued for use. Clarified and added comment to Section 1.3: Clarified section and added comment "Source Control SIMOPS Director covers an area of appr. 1,000-m from site". Added Sections 6.9 on Aviation and Section 6.10 on Helicopter Refueling. Added section 1.8 (HazID of operating in contaminated waters and added HazID documents. Updated contact details and general cleanup of doc. Added doc. number from Doc. Control.
1	G. Karlsen	April 29, 2010	Removed 1000-m radius circle from map Fig. 9 and updated with debris field.

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FIGURES

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1 Introduction

1.1 SIMOPS Plan Objectives

The goal of the MC-252 Incident Simultaneous Operations (SIMOPS) Plan is safe and efficient execution of the SIMOPS between all marine and aviation assets deployed in support of the spill and source control operations. The majority of the assets are provided or sourced by:

- Transocean Offshore Inc.
    - Development Driller III (DD III) semisubmersible
    - Discoverer Enterprise (DEN) drillship
- BP Logistics and Aviation (PHI, Chouest, Tidewater, VIH Cougar, Graham Gulf)
- Marine Spill Response Corp (MSRC)
- National Response Corp (NRC)
- Aker Marine
- Subsea 7
- Airborne Services Inc (ASI)
- USCG

The plan seeks to:

Inform members of the unified command involved in SIMOPS for the MC-252 Incident of the principles required for conducting simultaneous operations.

Identify the SIMOPS hierarchy for the major scopes of work between Spill Recovery, Well Control operations and drilling of relief wells.

Outline high-level procedural steps complimented by the detailed processes, procedures and plans (3P) issued by the respective groups. The 3P's are issued and reviewed in conjunction with Hazard Identification (HazID) assessments or planning meetings just prior to the SIMOPS event.

Concurrent operations onboard the assets described above are NOT covered or included in the SIMOPS Plan unless these activities affect other MC-252 Incident operations.

1.2 What Does Success Look Like?

Success is defined as zero SIMOPS clashes, zero SIMOPS impact to schedules and zero SIMOPS incidents. Getting to zero is only possible by strict discipline in the part of all stakeholders to adhere to the elements of the plan.

Remember: "Good SIMOPS is all in the communications."

1.3 The SIMOPS Team

SIMOPS Director - Overall responsibility for coordinating the execution of SIMOPS events. The SIMOPS Director resides in Houston.

Offshore Spill Operations SIMOPS Branch Director - Overall responsibility for coordinating the execution of Spill SIMOPS events. Position resides onboard Louisiana Responder.

Offshore Source Vessel Control SIMOPS Branch Director - Overall responsibility for coordinating the execution of Source Vessel Control SIMOPS events. Position resides offshore onboard the DD III or the Discoverer Enterprise. The Branch Director generally controls the areas inside the rigs 500-m zone and an area of appr. 1,000-m from the Macondo site. See **Figure 8**, page 35.

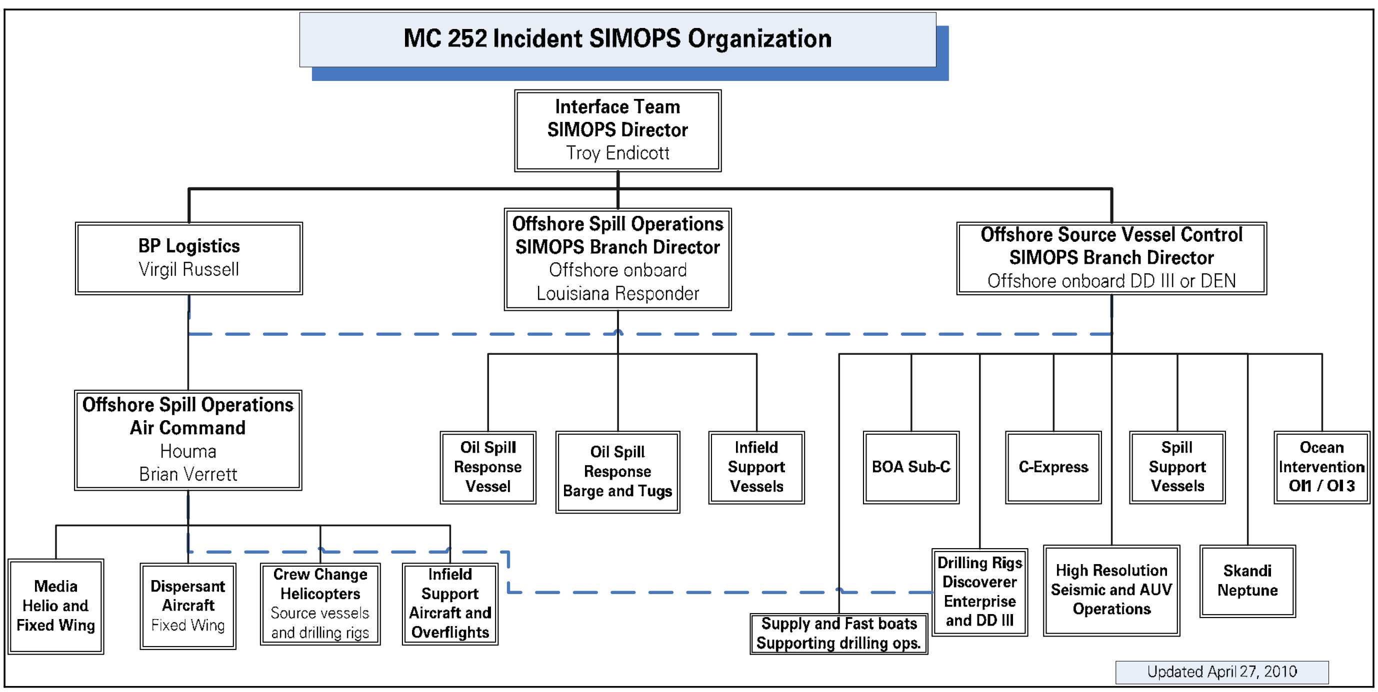
BP Logistics - Overall responsibility for providing air support to the project. Group resides in Houston.

Offshore Spill Operations Air command - Overall responsibility for coordinating and scheduling all aircrafts including fixed wing, crew change helicopters, dispersant deployments, over flights, recons and spotter planes. Position resides in Houma.

Vessel Person in Charge (VPIC) – Is the BP Vessel Rep. onboard. Can also be the OIM or the Well Site Leader. The VPIC is responsible for all Health, Safety, Security and Spill (HSSE) incidents. All incidents will be reported using the Notification scheme contained within the plan.

Note: Any person involved in a SIMOPS event has the authority and obligation to discontinue and shut down the SIMOPS event in the case of safety or operational concerns.

Figure 1: SIMOPS Communications Plan



SIMOPS events will be coordinated through daily SIMOPS call as per Section 2.5, page 14.

1.3.1 Onshore SIMOPS Director Responsibility

- Chair the daily SIMOPS call (see Section 2.5, page 14).
- Be the overall coordinator of SIMOPS activities at MC-252 Incident.
- Ensure SIMOPS events comply with HSSE guidelines.
- Identify need of SIMOPS HazIDs and SIMOPS reviews prior to a SIMOPS event.
- Assess potential schedule impact and associated risks from upcoming SIMOPS events.
- Liaison with leadership team on SIMOPS issues, scheduling and technical conflicts.
- Identify critical path and determine which operation has priority.
- Assess risks of single and multiple operations and SIMOPS events.
- Facilitate resolutions of any SIMOPS conflicts with the teams.
- Coordinate SIMOPS issues between the Discoverer Enterprise, DD III, Marine Activities and Aviation.

1.3.2 Offshore Spill Operations SIMOPS Branch Director Responsibility

- Be the overall coordinator of the execution of SIMOPS activities in the spill clean up operation.
- Direct vessels as per the daily operating plan.
- Identify resource needs.
- Liaison with the vessels in the cleanup fleet.
- Ensure spill cleanup SIMOPS events comply with HSSE guidelines.
- Assess potential schedule impact and associated risks and convey to the SIMOPS Director.
- Work with vessel Captain on all SIMOPS and HSSE.

1.3.3 Offshore Vessel Source Control SIMOPS Branch Director Responsibility

- Be the overall coordinator of the execution of SIMOPS activities in the fleet of source vessels.
- Area of responsibility is in the Macondo well area and the debris field out to appr. 1,000-m from site.
- Direct vessels as per the daily operating plan.
- Identify resource needs.
- Liaison with the source vessels.
- Ensure vessel activities comply with HSSE guidelines.
- Assess potential schedule impact and associated risks and convey to the SIMOPS Director.

1.3.4 Vessel Representative (VPIC)

Source control vessels and possibly some of the spill cleanup vessels will have a vessel rep. onboard. The vessel rep. responsibility is to:

- Implement specific programs concerning ROV, salvage, search and clean-up.
- Ensure HSSE and safety guidelines are followed onboard the vessel and in vessel ops.
- Provide guidance for the specific operation.
- Comply with operating procedures and applicable MC-252 Incident SIMOPS requirements.
- Work with vessel OIM or Captain on SIMOPS issues.
- Call-in on the daily SIMOPS call.

1.3.5 SIMOPS Interface Team (Member)

Assigned for each area of operations, such as well operations, ROV operations, spill clean-up, AUV and 2D Seismic surveying, Salvage and Recovery operations. The position resides onshore. Responsibilities are:

- Implement specific installation and construction programs.
- Arrange SIMOPS review meetings and HazIDs.
- Comply with operating procedures and applicable MC-252 Incident SIMOPS requirements.
- Establish communication plan between their SIMOPS supervisory personnel.
- Assist the MC-252 Incident SIMOPS Director in implementing the MC-252 Incident SIMOPS Plan.
- Provide progress report to the MC-252 SIMOPS Director.

1.4 Management of Change (MoC)

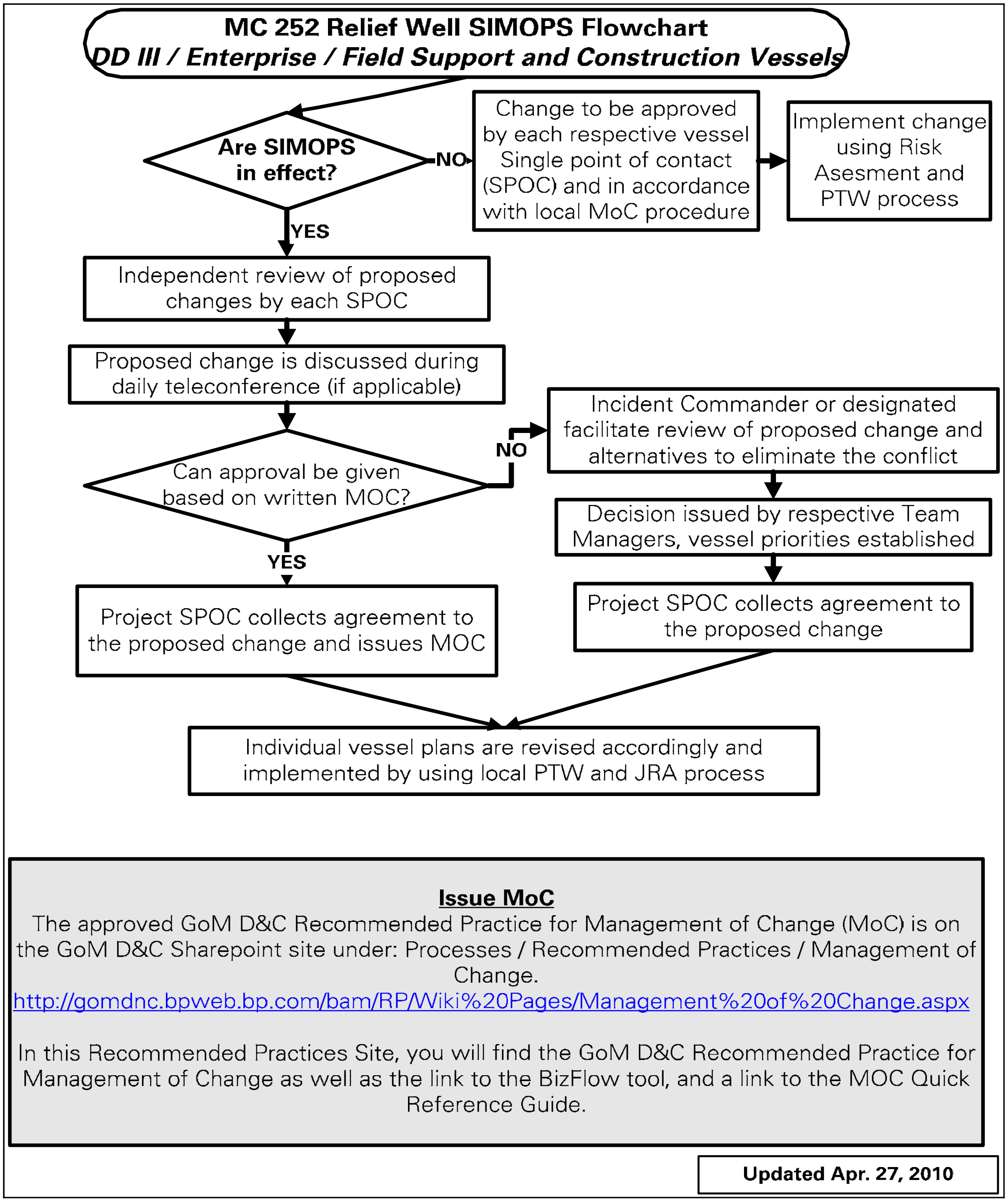
The MoC process is used in conjunction with changes to procedures and the SIMOPS schedule. Temporary and permanent changes are managed to ensure that health, safety, and spill risks remain at acceptable levels. The plan intends to exceed BP's Operations Management system (OMS), expectations, regulatory requirements and local needs.

Figure 2, page 11 shows the SIMOPS MoC procedure for changes in the MC-252 Incident program.

The GoM MoC process uses BizFlow found at the BP Intranet site:

http://gomdnc.bpweb.bp.com/bam/RP/Wiki%20Pages/Management%20of%20Change.aspx

Figure 2: MC-252 Incident SIMOPS MOC Process



1.5 HazID Assessing Operations in a Contaminated Environment

A HazID was held April 28, 2010 to assess the risks of the Discoverer Enterprise and the DD III being exposed to hydrocarbons either from a sheen or from a plume of oil. The HazID followed Trans Ocean's internal HazID the previous day.

There were no show stoppers identified during either HazID. The Operation Teams of the Discoverer Enterprise and the DD III were tasked with the assembly of an emergency disconnect plan should the direction of the plume change towards the rigs or should there be a catastrophic change to the volume of released hydrocarbons.

The HazID action items are found in Table 1 below.

Table 1: HazID Action Items

	Activity	Action	Responsible Person	Due Date
1	**Rig Operations**	Develop a decision matrix for various scenarios of increased oil flow that could impact the drill rig.	George Gray	
2		Include in IAP that source control immediately communicates any flow changes to the SIMOPS Director	Troy Endicott	Prior to ops.
3		Develop a model to predict plume location based on subsea currents. Consider the impact of rapidly increasing flow rate.	Troy Endicott	
4		Determine the location and density of oil/water emulsion / mousse floating below the surface.	Troy Endicott	
5		Convey IMT air monitoring and safety plan to the vessels.	Joe Neumeyer	Prior to ops.
6	**Other Operations**	Send 500 meter zone to branch directors.	Troy Endicott	Prior to ops.
7		Communicate to the IMT the drill rigs request to maintain a minimum of one mile distance for dispersant application or in situ burning.	Troy Endicott	Prior to ops.

The risk ranking and HazID results are found in Figure 11, page 41, Figure 12, page 43 and Figure 13, page 45.

2 Field Communications and Emergencies

2.1 Crisis Management

The Gulf of Mexico Deepwater Development (GoM DWD) Emergency Response Plan Guidelines are initiated should any emergency occur during a SIMOPS event. The SIMOPS event will be terminated or postponed until the emergency is cleared.

Any emergency onboard the Discoverer Enterprise, the DD III or associated vessels will be reported immediately to the other vessels and the Offshore SIMOPS Branch Director to ensure necessary precautions can be taken.

2.2 Severe Weather Contingency Plan

See GoM IMS Vol. III – Severe Weather Contingency Plan (see References in Section 7, page 48).

The Crisis Center at WL-4 handles the management of severe weather planning and field evacuation guidance.

2.3 Emergency Evacuation Plan

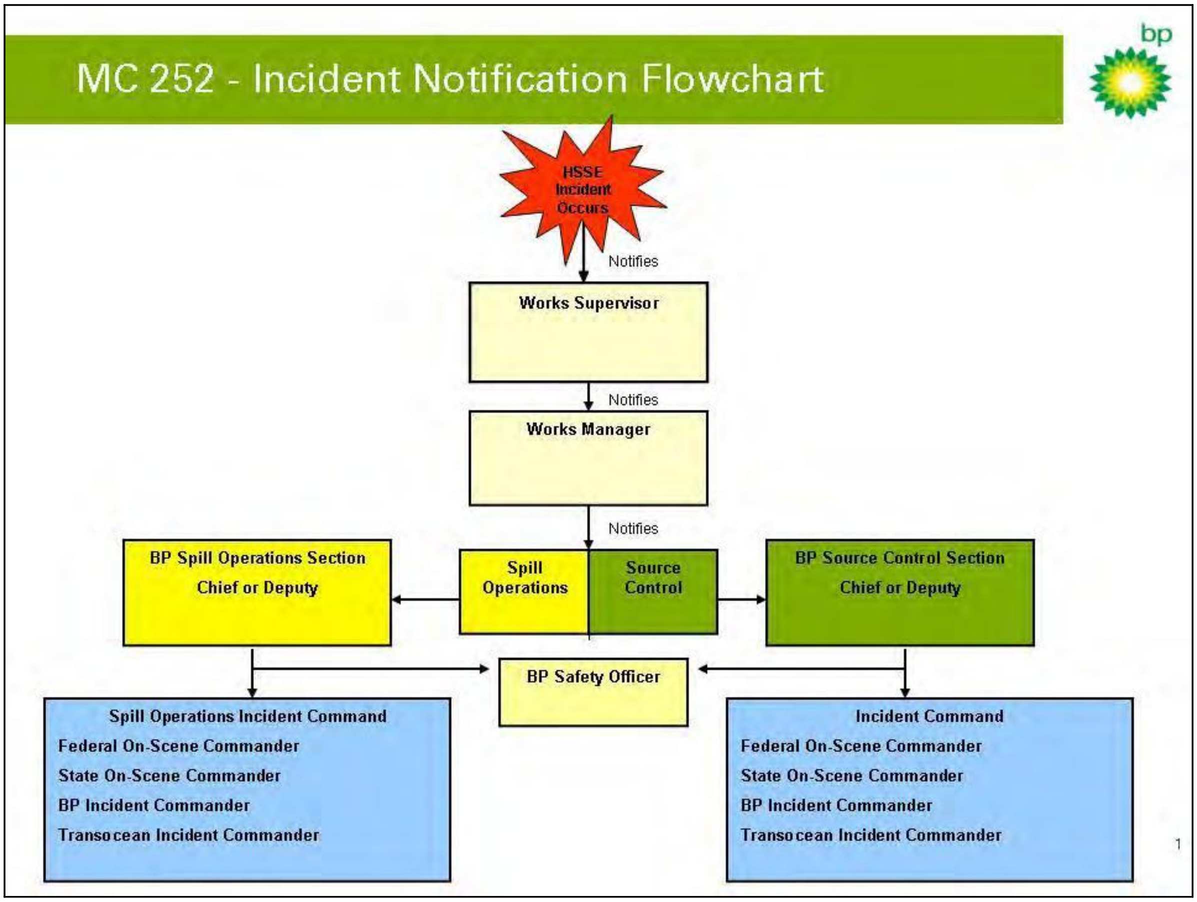
See GoM DWD Emergency Evacuation Plan (see References in Section 7, page 48).

2.4 Incident Notification

The Incident Notification Chart shown in Figure 3, page 14 is the main routing of incident notifications on the project.

It is recognized, however, that the MC-252 Incident operation is complex and that there is a possibility of incidents being reported through different channels.

Figure 3: Incident Notification Chart



2.5 Daily SIMOPS Conference Call

The SIMOPS Director chairs the daily SIMOPS conference call.

The following calls in to the SIMOPS call:

1. Each MC-252 Incident ROV and construction vessel
2. The lead spill clean-up vessel.
3. Houma IC.
4. Houston IC.
5. Discoverer Enterprise and DD III OIM and Well Site Leader (WSL) or designees.
6. BP vessel rep. and PIC on vessel(s) performing SIMOPS in the MC-252 Incident field.
7. Impact Weather and Horizon Marine (only if met-ocean conditions dictate).
8. Shore-based personnel as required

Work boats and fast boats are not required to participate.

The purpose of the daily SIMOPS conference call is to:

- Provide daily SIMOPS support to all MC-252 Incident groups.
- Get the latest met-ocean updates (Impact Weather and Horizon Marine to participate on an as-needed-basis).
- Ensure all activity centers are fully aware of ongoing and upcoming field activities and SIMOPS events.
- Review SIMOPS schedule issues.
- Ensure activities from outside operators (such as pipe-lay and seismic operations) are flagged.
- Review VHF and acoustics communication needs and clashing issues.
- Ensure the SIMOPS events are planned and executed according to the program with no impact to HSSE and minimum impact to other operations.

Table 2 below shows the details of the conference call center.

Participants call the Toll-free or the Toll numbers and then the Pass-code to get into the conference call.

Table 2: Conference Call Center

Dial-In Numbers and Pass Codes	Toll-Free number from inside USA:	1-866-634-1110
	Participant pass code:	925-727-0145

Each operation issues a daily SIMOPS report to the SIMOPS Director that is reviewed prior to the SIMOPS call. The report is a short synopsis of last 24-hours and the coming 24-hours utilizing Incident Action Plan (IAP).

The SIMOPS call agenda is:

- Met-ocean update (wind, waves and currents).
- Sheen, plume and marine debris update.
- Vessel Summary
  - Discoverer Enterprise – Current operations, SIMOPS events, next activity, special issues, Q&A.
  - DD III – Current operations, SIMOPS events, next activity, special issues, Q&A.
  - ROV vessels – Current operations, special issues, Q&A.
  - Construction and intervention vessels – Current operations, SIMOPS events, next activity, special issues, Q&A.
  - Barge and tugs – Update on current operations and next 24-hrs.
  - Spill clean-up vessels – Area of operation, sheen and plume update.
- SIMOPS issues, communications and VHF use, scheduling, conflicts and concerns.

2.6 SIMOPS Communication Guideline

Well-planned and established communications are keys to the successful execution of the MC-252 Incident SIMOPS. The SIMOPS Branch Directors must communicate with the respective Vessel Reps. / OIMs / Captains prior to the start of any SIMOPS activity and during the SIMOPS event as conditions require.

Remember: "Good SIMOPS is all in the communications."

2.7 Field Communications

2.7.1 Hailing Channels VHF 15 and VHF 16

Vessels approaching the field will use Channels 15 or channel 16 to call up the Discoverer Enterprise or the DD III Bridge. Channel selection, following the initial hailing is agreed upon with the respective installation.

Channel 15 and channel 16 are always monitored by the Discoverer Enterprise and the DD III. See Table 3, page 16.

Once the appropriate MC-252 Incident facility (Discoverer Enterprise or DD III) is hailed, the channel is switched to an agreed frequency as per Table 3. The table is a guideline and lists the agreed MC-252 Incident VHF channels. It is anticipated that radio noise and high usage may require selection of other channels at times.

<u>The fleet of Source Control and Oil Spill Response vessels will work through the Onshore SIMOPS Director to establish field radio procedures and agree on channel selections.</u>

Radio use and frequency selection will be part of the daily SIMOPS call.

Table 3 below shows the VHF hailing and the working channels for the MC-252 Incident field.

Table 3: VHF and UHF Working Channels

Location	Discoverer Enterprise	Discoverer Enterprise ROV	DD III	DD III ROV
Hailing general	16		16	NA
Bridge to Bridge	15		13	
Bridge to boat	10, 11, 12		13	
Port crane	10, 11, 12		67	
Starboard crane	10, 11, 12		68	
Crane to boat	10, 11, 12		Port: 67, Stb. 68	
Bulk and liq. Transfer	8, 15		72, 88	
ROV	No radio	8		72, 88
Discoverer Enterprise Bridge to maintenance	64	NA	NA	NA
Spare channels	6, 69, 71, 73		6, 69, 71, 73	
UHF	2, 5, 9		3, 6, 9, 13	3, 6, 9, 13
Helicopter	123.05		122.700	
Notes:	Source control vessels and environmental cleanup vessels are hailed on ch. 15 and ch. 16			
				Updated April 27, 2010

2.7.2 Radio

Vessels and aircraft, under contract to BP, are equipped with BP radios in addition to the contractor's communication equipment.

Operators of vessels involved in SIMOPS activities must agree upon *primary* and *secondary* radio communication frequencies prior to the start of any SIMOPS activity.

Note: Conduct radio check and confirm operability prior to start of any SIMOPS event.

2.7.3 Emergency Communications

For emergency response communication procedures and contact information, reference the "GoM DWD Emergency Response Plan" (see Section 7, page 48).

3 Acoustic Frequency Management and Position Referencing

The Acoustic Frequency Management Plan is summarized in Table 6, page 22 and in Figure 10, page 39.

Please note the following:

1. Horizon DP array transponders have been recovered and are not featured in the plan.
2. It is essential that all vessels with dual head HiPAP systems configure the system to track all transponders from a single head (all transponders tracked from the same head).

3.1 Enabling and Disabling of Transponders and Responders

The Dynamic Positioning Operator (DPO) onboard the Discoverer Enterprise and the DD III are responsible for the management and safe use of the acoustic frequencies at MC-252 Incident.

No acoustics will be turned on or off without the concurrence of the DPO onboard the Discoverer Enterprise and the DD III.

Warning:	**The Discoverer Enterprise and the DD III DPO will manage the acoustics in the MC-252 Incident field. There will be no enabling or disabling of acoustic channels without the DPO's concurrence.** **Do not change allocated channels without the concurrence of the Discoverer Enterprise and the DD III DPO. The main requirement of the Acoustic Management Plan is to prevent frequency clashing and risk interference or loss of acoustic position referencing for the Discoverer Enterprise and the DD III.**

Note that any noise issues degrading the acoustic position reference system *MUST* be reported to the OIM and the Well Site Leader. Under no circumstances should the acoustic system be disabled because of degraded signal to noise ratio. Disabling the acoustic system would bring the rig from a DP Class II to a DP Class I DP operation. **Note: TOI approval contingent on: "**acoustic system may be taken out of solution if degraded".

3.2 Safe Distance

The Frequency Management Plan assumes there is no safe distance where acoustics will not interfere, especially with the short distance between vessels. The plan produced a set of compatible channel allocations and guidelines that will allow each vessel to operate freely without concern as to the effect on other vessels nearby.

3.3 Echo Sounder Turnoff

Any vessels entering the MC-252 Incident area must turn off the echo sounders within 5-nm of arriving in the MC-252 Incident field. This is to ensure echo sounders do not create noise in the water column and

interfere acoustically with any of the vessels using acoustic communications. Do not turn on echo sounders until the vessel is outside this 5-nm limit.

Caution:	**Compliance with the echo sounder turnoff while in the MC-252 Incident field is mandatory.**

It is the responsibility of each MC-252 Incident group contracting vessels, the Logistics Group and the Fourchon Base to notify and inform the MC-252 Incident vessels of the Echo Sounder turnoff requirements.

3.4 Acoustic Frequency Coordination

3.4.1 Coordination of Acoustic Activities

All information, regarding the coordination of the MC-252 Incident Acoustic Frequency Management Plan, is directed to the respective rig's Team Leader.

Jonathan Davis with BP, Dave Ross with UTEC Survey, together with Kongsberg and Sonardyne, will assist in troubleshooting frequency clashes and interferences (see phone list for contact details).

3.5 Acoustic Equipment Use Notifications

Source vessels will work in close proximity to the Discoverer Enterprise and the DD III. These vessels must follow the Frequency Management Plan and the acoustic guidelines before enabling acoustic equipment.

3.5.1 Acoustic Field Operations

For acoustic operations at MC-252 Incident, vessels will inform the DEN and the DD III Bridge of arrival in the field. The following must take place prior to commencement of acoustic operations:

- Confirm field arrival and departure.
- Confirm all frequencies in use by the Discoverer Enterprise and the DD III as per Table 6, page 22.
- Confirm pre-approved acoustic channel allocations for the upcoming operation.
- Advise the Discoverer Enterprise and DD III of minimum proximity requirements between vessels.
- Advise the Discoverer Enterprise and DD III DPO when channels are enabled and disabled.
- Advise the Discoverer Enterprise and DD III DPO of source vessel channel selections.
- Be prepared to immediately disable acoustic channels in case of degradation of the Discoverer Enterprise and the DD III acoustic position reference systems.
- Discoverer Enterprise and DD III to advise vessel of any acoustic position reference system response and degradation from the added acoustics in the water column.

Caution:	**No vessel shall deploy transponders without first contacting the DEN and the DD III DPO and receiving confirmation as to channels in use. The DEN and the DD III and any vessels using acoustics will be in continuous communications concerning acoustic noise and frequency clashing.**

3.6 Fan Beam

Fan Beam is a position reference system used while vessels are in proximity. Workboats and supply boats, as well as vessels carrying out subsea construction, utilize Fan Beam. The system's maximum range is 2,000-m with an accuracy of $\pm$10 cm during optimum conditions. The system uses a laser beam and is, therefore, weather sensitive. The practical range for Fan Beam is in the range of 200-m to 400-m.

The key to a successful operation of the Fan Beam position reference system is to ensure the system is maintained, fully operational and in Green status and that the Fan Beam is set up according to the manufacturer's specifications.

Particular attention is required to the system setup. The gating parameters must be set correctly to ensure the intended target is followed. This may have been a problem in the past. There are known instances where the laser beam has locked onto a moving object onboard the adjacent vessel. The moving object may have been someone in coveralls with reflective tape.

Note: Any vessel working the MC-252 Incident area and using Fan Beam as a relative position reference system, must confirm that the system is operational according to manufacturer's specifications before the system is allowed to be used near the DEN, the DD III.

The Fan Beam User Guide v. 4.1 is listed as a reference in this document. *The user, however, shall always check with the manufacturer to ensure the correct and latest version of the user guide is utilized for setting up the Fan Beam systems on the particular vessel*.

The MC-252 Incident vessels have their Fan Beam laser units installed at different heights. Adjustments may be required in the height of the prisms installed on the Discoverer Enterprise and the DD III to conform to vessel requirements.

The Discoverer Enterprise and the DD III OIM should determine correct prism height and location based on communications with the respective user of Fan Beam systems. Table 4, page 20 lists the Fan Beam height for some vessels which may be used at MC-252 Incident.

Table 4: Fan Beam Height

MC-252 Incident Vessels	Fan Beam Height Above Sea Level	Ideal Reflector Height above Sea Level
		The reflector height is determined by the application and distance between vessels and is generally set at Fan Beam height -0 +17-ft.
Schlumberger DeepSTIM II	44-ft.	
Technip Deep Blue	102-ft.	
OI1	56-ft.	
OI3	74-ft.	
C-Captain	45-ft.	

There is a wide variation in Fan Beam installation heights between vessels. The Fan Beam prisms, installed on the DEN and the DD III, will require elevation and position changes, depending on which vessel is utilizing the system. Adjusting the height will improve the system performance and reduce Fan Beam positioning errors.

Table 5 below lists the MC-252 Incident vessels using Position Reference systems.

Table 5: Vessels using Position Reference Systems

MC-252 Incident Vessels	Available Position Reference System	Notes
Discoverer Enterprise	DGPS, Acoustics (Sonardyne digital)	DP Class II+
DD III	DGPS, Acoustics (HiPAP)	DP Class II+
Source control vessels	DGPS, Fan Beam and RADius. Acoustics for tracking and surveying	DP Class I and II Some vessels may not have been assessed for DP class
Spill clean-up vessels		Not assessed for DP class

3.7 RADius Position Reference System

The RADius position reference system measures relative distance between two adjacent vessels using the Doppler principle. The adjacent vessel is equipped with RADius transponder(s). The system has a range of approximately 1,100-m and is not affected by activities onboard the adjacent vessel. A transponder system consisting of a small box is installed onboard the host vessel (i.e., Discoverer Enterprise and DD III). The system requires a 120-volt power source. Range accuracy is 0.25-m.

Note: Any vessel, working the MC-252 Incident area and using RADius as a relative position reference system, must confirm that the system is operational according to manufacturer's specifications before the system is allowed used near the Discoverer Enterprise and the DD III.

Table 6: MC-252 Acoustic Allocation Summary

Vessel	Allocation
DD III DP	**DP** b31 DP b32 DP b35 DP b37 DP b73 DP b76 DP LIC
DD III	**ROV System** b14 Tracking b28 Tracking b34 Tracking b48 Tracking b54 Tracking b68 Tracking b74 Tracking
DO NOT USE	**b12** **b13** **b15** **b17** **b51** **b52** **b53** **b57** **b71** **b72** **b75**
BOA SUB C	b18 SPARE b24 CRANE 1 b26 DP 1 b38 MILL 36 b46 SPARE b58 MILL 36 SPARE b64 CRANE 2 b78 MILL 37 b84 MILL 37 SPARE b86 DP 2
MISS GINGER	b27 Emergency AUV b42 AUV b47 SPARE b62 SEABIRD b67 SPARE b82 SPARE b87 SPARE
OI 3	b16 Tracking b23 Tracking b36 Tracking b43 Tracking b56 Tracking b63 Tracking b83 Tracking
SKANDI NEPTUNE	b21 Tracking b25 Tracking b41 Tracking b45 Tracking b61 Tracking b65 Tracking b81 Tracking b85 Tracking
OI-3	**Wideband Family 12 (see below)** Address 1201, CIS 1 ROV 1 Address 1202, CIS 2 ROV 1 Cage Address 1203, CIS 3 ROV 2 Address 1204, CIS 7 ROV 2 Cage
C-Express	**Wideband Family 15 (see below)** Address 1512, CIS 4 ROV Address 1513, CIS 5 ROV Backup Address 1514, CIS 6 ROV TMS

Discoverer Enterprise DP array: Sonardyne wideband Family 14, CIS. Ch. 1409, 1410, 1411, 1412, 1413

The acoustic allocations for all construction vessels are found in Figure 10, page 34, Figure 11, page 35 and Figure 12, page 35.

It is imperative that the plan is adhered to and that there are no changes without preapproval.

The DD III ROV channels may be utilized bby others if not required by the DD III operation.

CIC = Common Interrogation Signal

4 SIMOPS Events

4.1 SIMOPS Events

The SIMOPS plan contains multiple events and interfaces between the Discoverer Enterprise at relief well location RxC and DD III at relief well location RxD.

Anticipated SIMOPS events are:

- Discoverer Enterprise operating at relief well location RxC and DD III at relief well location RxD.
- Source control vessel activity inside the Discoverer Enterprise and the DD III 500-m exclusion zones.
- Source control vessel activity alongside the Discoverer Enterprise and the DD III.
- Spill clean-up vessel activity inside the Discoverer Enterprise and the DD III 500-m exclusion zones.
- Pumping vessel alongside Discoverer Enterprise or DD III.
- Salvage operations.
- Barge and tug boats.
- Aviation.
- In-situ burns (requires separate risk assessment and approval).

Note: There is no requirement to develop a separate SIMOPS procedure for any of the MC-252 SIMOPS events. Detailed project operating procedures specifically developed in conjunction with and referring to the MC-252 SIMOPS plan are required.

Table 7: SIMOPS Preplanning General Checklist

Activity	Well Site Leader	OIM	DPO
Vessel within 500-m of Discoverer Enterprise and DD III.	To be informed and approve arrival.	Approve.	Prepare DEN and DD III most favorable heading. Ensure communications to vessel are as planned.
In close proximity to, alongside or equipment hooked up to DEN/DD III.	To be informed.	Approve through Permit to Work (PTW) process.	Ensure communications to vessel are as planned.
Station-keeping alongside.	To be informed of met-ocean conditions and any heading change of DEN/DD III and vessel in SIMOPS.	To be informed of met-ocean conditions and any heading change of DEN/DD III and vessel in SIMOPS.	Communicate with vessel in SIMOPS on all DP matters.
Fan Beam prism installation.	To be informed of station-keeping readiness.	To determine correct height based on vessel alongside.	Ensure fully operational.
Degradation in station-keeping ability of vessel(s).	To decide on further action together with OIM.	~~Vessel Captain together with DEN/DD III~~ DPO to assess and decide on action according to WSOC. **Note: TOI strike out. Approval contingent on DPO making decision according to WSOC.**	
SIMOPS with other ops.	To be informed.	To approve.	Requirements as above.

4.2 Emergencies during SIMOPS Events

Emergencies onboard one of the vessels involved in SIMOPS impact the ability to proceed with SIMOPS. The SIMOPS planning should specifically address emergencies during SIMOPS events, mitigations and restrictions associated with such emergencies.

Use the following guidelines to shut down or postpone the SIMOPS event, which may reduce the ability of personnel to respond effectively to an emergency:

- Sheen, plume or surface debris that could impact the SIMOPS event.
- Any condition the OIM, Captain or the BP Well Site Leader determines to exist or develop and which would compromise safety of crews, equipment or vessels during the SIMOPS execution.
- Any event where acoustics communications are interfering with station-keeping of any vessel.
- Any fire requires vessels to suspend activities except those required to handle the event.
- Any hull emergency requires vessels to suspend activities except those that are required to handle the event.
- Any loss of firewater pumps requires vessel to suspend all activities at a secure point.
- Any loss of communication requires vessels to suspend all activities at a secure point.
- Any met-ocean event that could jeopardize station-keeping or operations during the SIMOPS event.
- Any event that takes a vessel out of readiness condition such as power, cooling and fuel systems, power management system, position reference systems and DP system.

4.3 SIMOPS Approval

The complexity of the SIMOPS activity determines the level of approval required for the work plan. Use the following procedure as a guideline:

- The SIMOPS Director has the overall responsibility for determining SIMOPS priorities and give necessary approvals following review with Branch Directors and Air Command.
- The SIMOPS Branch Directors approve SIMOPS events within their fleet after review with the SIMOPS Director and the respective vessels.
- The vessel OIM / Captain approves SIMOPS events associated with the respective vessel.
- The BP Well Site Leader, with input from the respective OIMs and Branch Directors determine the level of authority required to approve a safe work plan for a more complex activity inside the Discoverer Enterprise and the DD III 500-m zones.

5 Dropped Objects Prevention

5.1 Drilling Vessels

Any dropped object is to be reported through regular channels. There are no infrastructure concerns at the respective well sites. There are a number of pipelines and wellheads in the area, so dropped object prevention must have the same focus as when working in any of BP's fields.

5.2 Source Vessels and Marine Clean-up Vessels

Any dropped object must be reported as per the Incident Notification Chart. The Discoverer Enterprise and the DD III Bridges should be notified as well on any dropped object incident.

Caution:	**Vessels inside the MC-252 Incident field MUST promptly report a dropped object incident to the DEN and the DD III Bridge.**

6 Area Vessel Control and Aviation

The key to vessel control is through good communications. The daily SIMOPS call is the main venue to inform of upcoming vessel activities and requirements.

6.1 Surface Conditions

Marine debris and hydrocarbons will to a large extent determine activities at MC-252 Incident. An assessment is being made on DEN and DD III operability while being exposed to a surface sheen or the plume. Daily updates on sheen and plume developments together with marine debris updates are provided to ensure appropriate marine decisions can be made.

6.1.1 Sheen and Plume

It is likely that the DEN and the DD III will be exposed to a sheen or the plume. This depends on met-ocean conditions and the volume of hydrocarbon (HC) being released. The DEN and the DD III bridges will stay in communications with the Spill clean-up vessels and be notified of any changes in weather patterns that may result in HC reaching the well sites.

6.1.2 Marine Debris

Discovery of marine debris will be broadcasted to the fleet by the first observer. Recovery will be handled by the appropriate team as required.

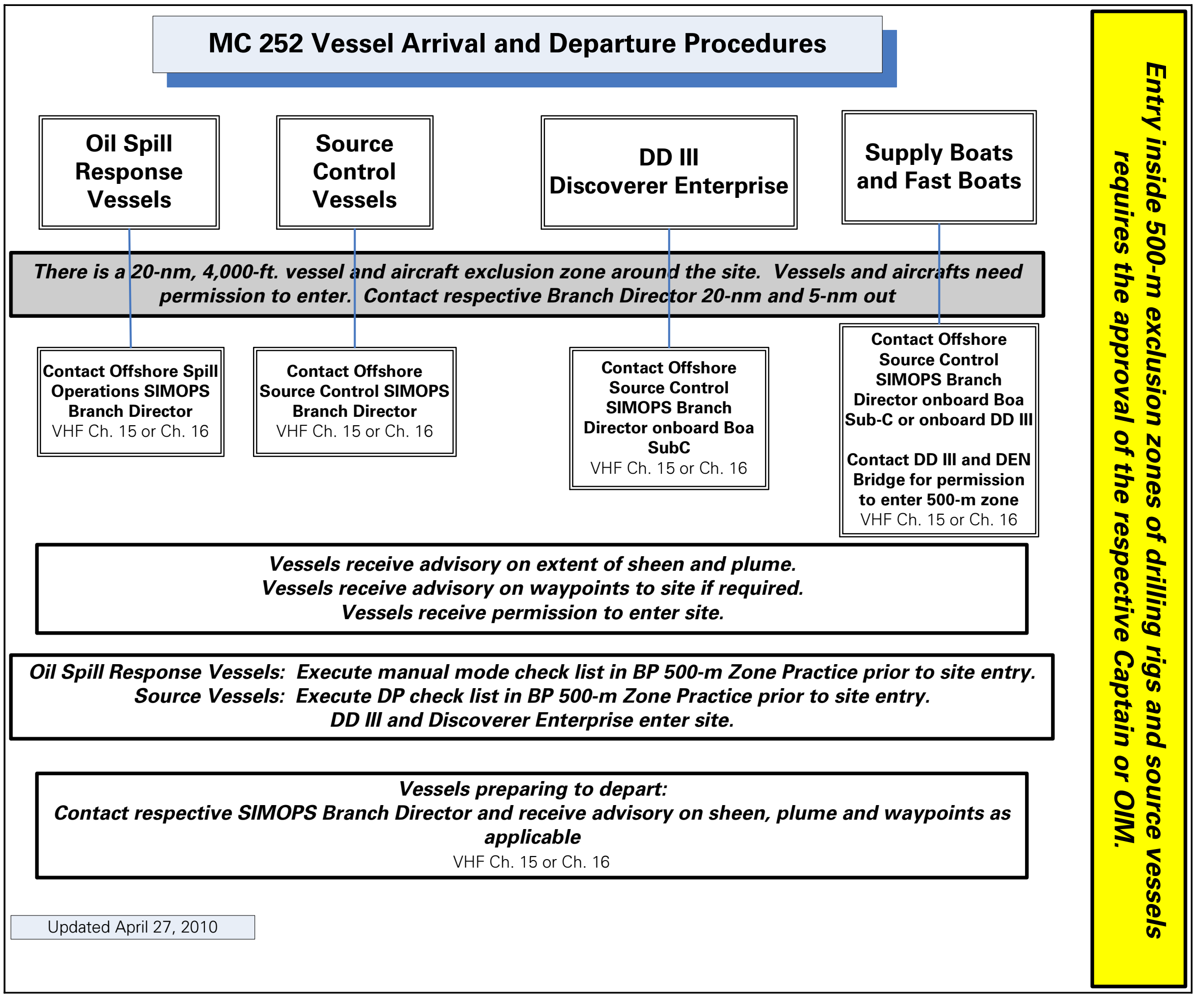
6.2 Vessel Arrival at MC-252 Incident

Surface and marine debris conditions determine how vessels arrive at the MC-252 Incident site. A Marine Debris Exclusion Zone map in Figure 7, page 33.

6.2.1 Arrival and Departure Procedures at MC-252 Incident

Vessel arrival and departure will follow the procedures set up in Figure 4, page 27. The number of vessels on DP and connected to the seabed either trough drilling risers or ROVs requires careful planning of vessel movements.

Figure 4: Vessel Arrival and Departure Procedures



6.3 Drilling Vessels

The DD III and the DEN are arriving from the SW and will move on to location from the standby and staging area once receiving approval through the Team Leader.

6.3.1 Staging Area

The DD III and the Discoverer Enterprise will move to the Staging and Standby area in MC 339 as shown in Figure 5, page 30. Preparations to start operations may be carried out at this location until approval is received for moving to the well location or the standby area to the south of the well location (see next section).

6.3.2 Standby Area

The DD III and the Discoverer Enterprise will move to the Standby area from the Staging area where operations will commence. The Standby areas are located 3,000-ft. to the south of the relief well locations RxC and RxD as seen in Figure 7**,** page 33. Conductor and tubulars may be deployed at this point.

The Standby areas are approximately half distance between the well centers and the ENI pipeline to the south (see **Figure 7**, page 34).

6.4 Source Control Vessels

Source vessels will be directed through the Incident management Command and are not expected to interact with the Discoverer Enterprise and the DD III to any extent.

The Discoverer Enterprise and the DD III 500-m exclusion zones will be adhered to. Entry into any of these zones requires Discoverer Enterprise or DD III OIM approval.

Please note that the Discoverer Enterprise and the DD III 500-m exclusion zones overlap. Any passage between the two rigs will, therefore, require Discoverer Enterprise and DD III OIM approval.

6.5 Oil Spill Response Vessels

Oil spill response vessels will be directed through the Incident Management Command via the SIMOPS Branch Director and are not expected to interact with the Discoverer Enterprise and the DD III unless the plume direction changes to the south.

It is essential that the Discoverer Enterprise and the DD III are notified of any clean-up vessel activity in the vicinity of the well operations and especially inside the rigs 500-m exclusion zones.

Note: The Discoverer Enterprise and the DD III 500-m exclusion zones will be adhered to. Entry into any of these zones requires Discoverer Enterprise or DD III OIM approval. Please note that the DEN and the DD III 500-m exclusion zones overlap. Any passage between the two rigs will, therefore, require Discoverer Enterprise and DD III OIM approval.

6.6 Hailing Channels VHF 15 and VHF 16

All vessels approaching the Discoverer Enterprise and the DD III will use VHF channels 15 and channel 16 to call up the Discoverer Enterprise or the DD III Bridge.

6.7 Working Channels

Once the targeted rig or vessel is hailed, the channel is switched to an agreed frequency as per Section 2.7, page 16.

6.8 GoM 500-Meter Zone Practice

Any vessel entering the 500-m exclusion zone of any MC-252 Incident vessel shall comply with the requirements in the 500-m Zone Practice. The document is issued by the BP Marine Vessel Operations group.

The nature of the MC-252 Incident operation, however, requires flexibility in how vessels interact. It is anticipated that the Captains on the Source Control vessels and the Spill clean-up vessels review proximity requirements between vessels and have an agreement in place concerning procedures and safeties.

Entry into the DEN and the DD III 500-m exclusion zones, however, takes place according to the 500-m Zone Practice.

Caution:	**Critical vessel repairs and maintenance shall be performed either before or after the SIMOPS event. No critical vessel repairs will be performed during the SIMOPS event or inside the DD III or the Discoverer Enterprise 500-m zone (see details in the 500-m Zone Practice). A critical repair is defined as repair that could lead to single point failure and loss of station or vessel integrity.**

6.9 Aviation

The air command in Houma is an integrated part of the SIMOPS plan. The following types of air activities are expected:

1. Helicopter crew flights to drilling rigs and source control vessels.
2. Spotter planes and fixed wing surveillance
3. Areal spray of dispersants (four aircrafts in one dispersant sortie, four to five sorties per day).
4. Over-flights of fixed wing and helicopters.
5. Drone surveillance.
6. Press and media.

The MC252 area has a restricted airspace (TFR – Temporary flight restriction) of 20-nm from site up to a 4,000-ft. elevation. Flights inside this zone are controlled by the USCG cutter Harriet Lane on site. The air command in Houma plans all flights to the site and reports through the SIMOPS Director as shown in Figure 1, page 8.

6.10 Helicopter Fueling

Helicopter fueling operations will mainly take place onshore. The aviation group will arrange emergency fueling onboard offshore facilities if needed. It is emphasized, however, that using the Discoverer Enterprise and the DD III as fueling stations for non rig flights reduces the efficiency of the drilling operations because of shut-down of cranes and deck activities.

Figure 5: MC-252 Incident Regional Chart With 20-nm Restricted Zone

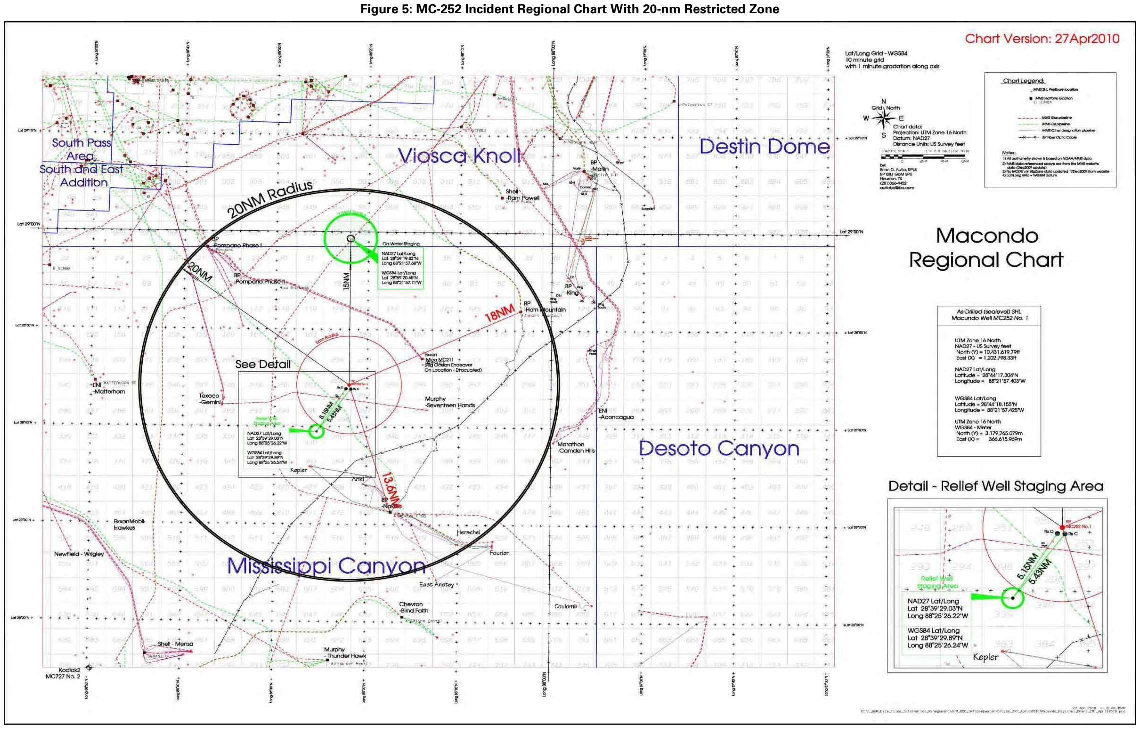


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Figure 6: MC-252 Incident Marine Debris Map

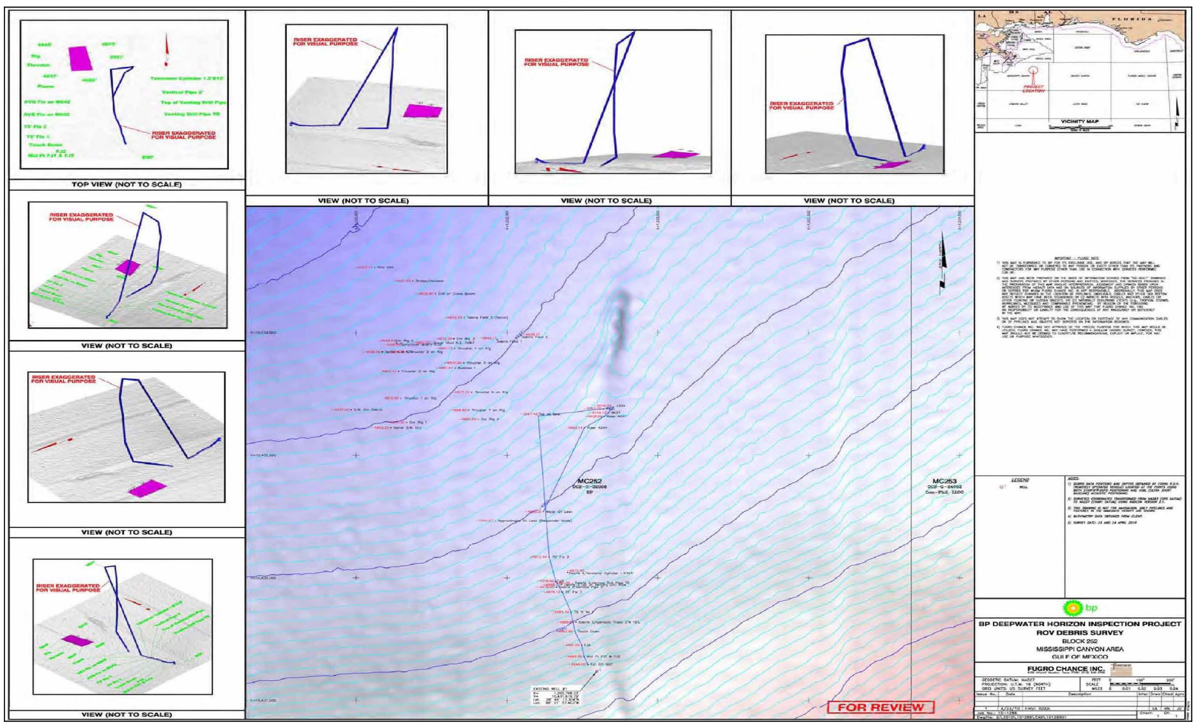

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Figure 7: Marine Debris and Discoverer Enterprise/DD III 500-m Exclusion Zones

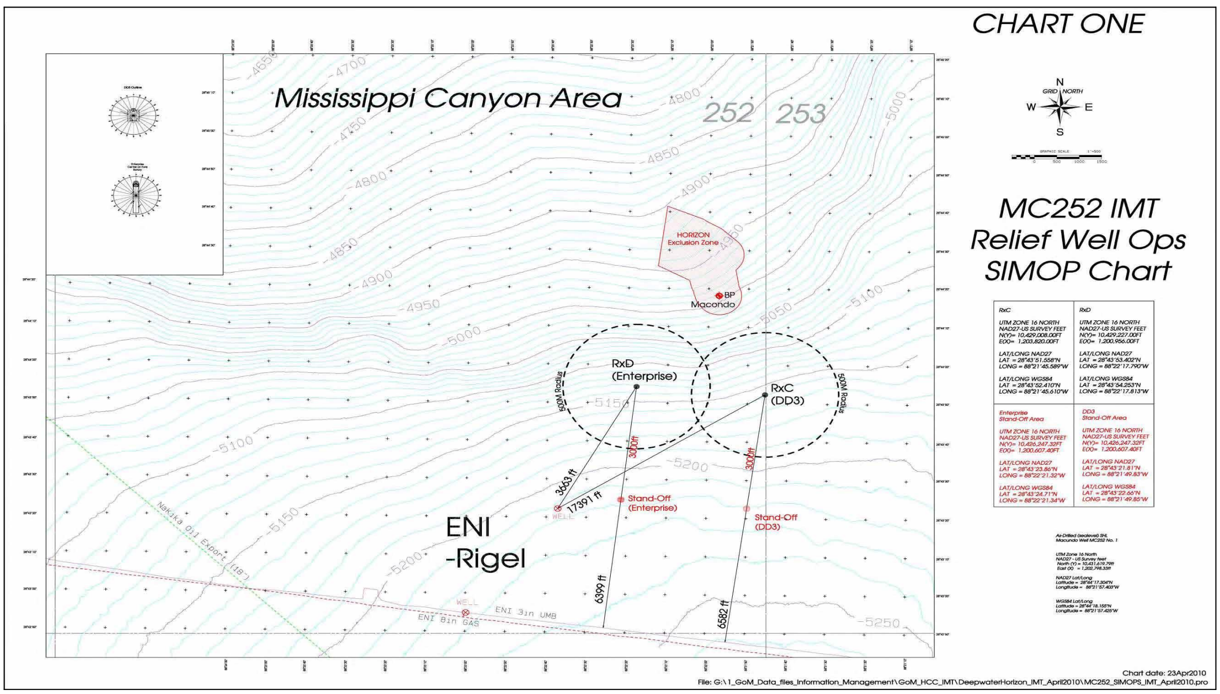

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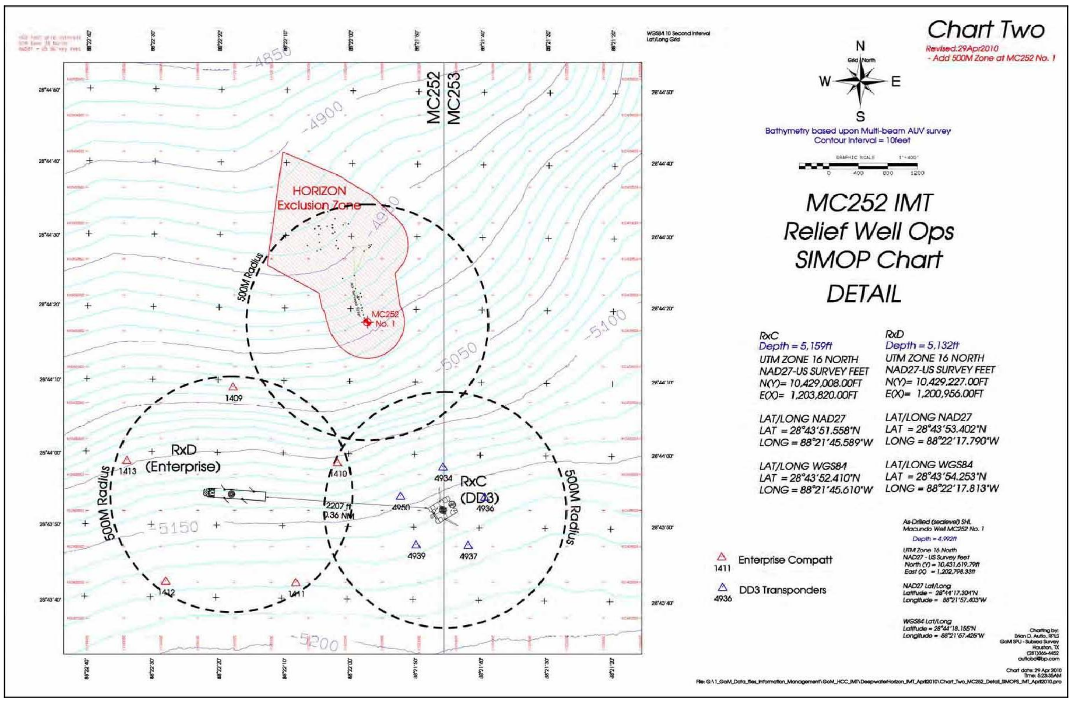
Figure 8: 500-m Vessel Exclusion Zone Detailed Map



Note: The Offshore Vessel Source Control SIMOPS Coordinator controls the debris field and an area within appr. 1,000-m of the MC 252 no. 1 well site.

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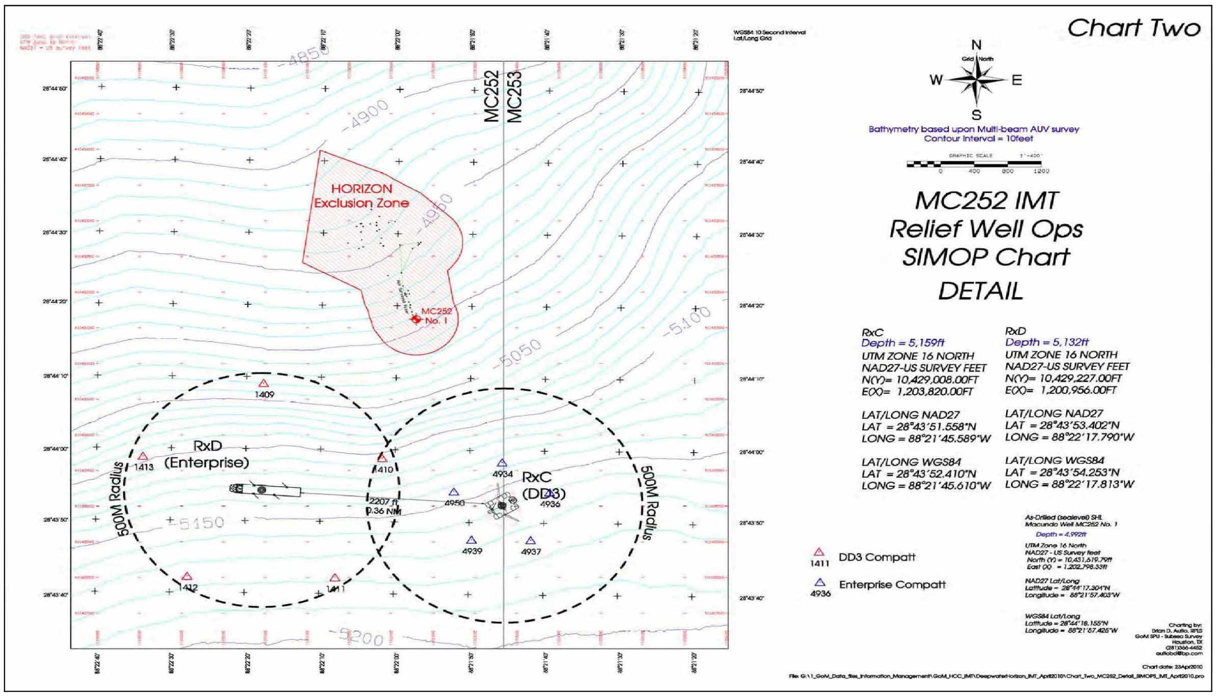
Figure 9: Discoverer Enterprise and DD III Transponder Grids



Title of Document:	Macondo Relief Well SIMOPS Plan	Document Number:	2200-T2-DO-PN-4001
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Security Classification:	Project Confidential	Page:	Page 38 of 55

Warning: Check DW Docs revision to ensure you are using the correct revision.

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Figure 10: Field Frequency Management Plan HiPAP vs. Sonardyne Digital

1. Discoverer Enterprise DP Array is now operating with Sonardyne MK5 Wideband COMPATTs. The array is setup for Family 14 ; C00.
LBL arrays installed at Thunder Horse must avoid allocating this family to remain clash free with the Discoverer Enterprise.

KONGSBERG HiPAP						SONARDYNE TONE CHANNELS																		
						CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CIF	CCF	CRF	CH0	CH9	DCF	CH10	CH11	CH12	CH13	CH14
VESSEL ALLOCATION	CH #	OPERATING CONDITIONS / PARAMETERS	TX1	TX2	RX	19230	19841	20491	21186	21929	22522	23148	23810	24752	25510	26042	26882	27472	28090	28735	29411	30120	30864	31645
DO NOT USE	b12	DO NOT USE	21000	21500	29250				X												X			
DO NOT USE	b13	DO NOT USE	21000	22000	29750				X	X														
DD III (VESSEL 3)	b14	Tracking	21000	22500	30250				X		X											X		
DO NOT USE	b15	DO NOT USE	21000	23000	30750				X			X											X	
OI 3 (VESSEL 4)	b16	TRACKING	21000	23500	27250				X									X						
DO NOT USE	b17	DO NOT USE	21000	24000	27750				X				X					X						
BOA SUB C (VESSEL 1)	b18	SPARE	21000	24500	28250				X					X					X					
SKANDI NEPTUNE (VESSEL 5)	b21	TRACKING	21500	21000	28500				X											X				
OI 3 (VESSEL 4)	b23	TRACKING	21500	22000	29500					X											X			
BOA SUB C (VESSEL 1)	b24	CRANE 1	21500	22500	30000						X											X		
SKANDI NEPTUNE (VESSEL 5)	b25	TRACKING	21500	23000	30500							X												
BOA SUB C (VESSEL 1)	b26	DP 1	21500	23500	27000												X							
MISS GINGER (VESSEL 2)	b27	EMERGENCY AUV	21500	24000	27500								X					X						
DD III (VESSEL 3)	b28	Tracking	21500	24500	28000									X					X					
DD III DP	b31	DP	22000	21000	28750				X	X										X				
DD III DP	b32	DP	22000	21500	29250					X											X			
DD III (VESSEL 3)	b34	Tracking	22000	22500	30250					X	X											X		
DD III DP	b35	DP	22000	23000	30750					X		X											X	
OI 3 (VESSEL 4)	b36	TRACKING	22000	23500	27250					X								X						
DD III DP	b37	DP	22000	24000	27750					X			X					X						
BOA SUB C (VESSEL 1)	b38	MILL 36	22000	24500	28250					X				X					X					
SKANDI NEPTUNE (VESSEL 5)	b41	TRACKING	22500	21000	28500				X		X									X				
MISS GINGER (VESSEL 2)	b42	AUV	22500	21500	29000						X									X				
OI 3 (VESSEL 4)	b43	TRACKING	22500	22000	29500					X	X										X			
SKANDI NEPTUNE (VESSEL 5)	b45	TRACKING	22500	23000	30500						X	X												
BOA SUB C (VESSEL 1)	b46	SPARE	22500	23500	27000						X						X							
MISS GINGER (VESSEL 2)	b47	SPARE	22500	24000	27500						X		X					X						
DD III (VESSEL 3)	b48	Tracking	22500	24500	28000						X			X					X					
DO NOT USE	b51	DO NOT USE	23000	21000	28750				X			X								X				
DO NOT USE	b52	DO NOT USE	23000	21500	29250							X									X			
DO NOT USE	b53	DO NOT USE	23000	22000	29750					X		X												
DD III (VESSEL 3)	b54	Tracking	23000	22500	30250						X	X										X		
OI 3 (VESSEL 4)	b56	TRACKING	23000	23500	27250							X						X						
DO NOT USE	b57	DO NOT USE	23000	24000	27750							X	X					X						
BOA SUB C (VESSEL 1)	b58	MILL 36 SPARE	23000	24500	28250							X		X					X					
SKANDI NEPTUNE (VESSEL 5)	b61	TRACKING	23500	21000	28500				X											X				
MISS GINGER (VESSEL 2)	b62	SEABIRD	23500	21500	29000															X				
OI 3 (VESSEL 4)	b63	TRACKING	23500	22000	29500					X											X			
BOA SUB C (VESSEL 1)	b64	CRANE 2	23500	22500	30000						X											X		
SKANDI NEPTUNE (VESSEL 5)	b65	TRACKING	23500	23000	30500							X												
MISS GINGER (VESSEL 2)	b67	SPARE	23500	24000	27500								X					X						
DD III (VESSEL 3)	b68	Tracking	23500	24500	28000									X					X					
DO NOT USE	b71	DO NOT USE	24000	21000	28750				X				X							X				
DO NOT USE	b72	DO NOT USE	24000	21500	29250								X								X			
DD III DP	b73	DP	24000	22000	29750					X			X											
DD III (VESSEL 3)	b74	Tracking	24000	22500	30250						X		X									X		
DO NOT USE	b75	DO NOT USE	24000	23000	30750							X	X										X	
DD III DP	b76	DP LIC	24000	23500	27250								X					X						
BOA SUB C (VESSEL 1)	b78	MILL 37	24000	24500	28250								X	X					X					
SKANDI NEPTUNE (VESSEL 5)	b81	TRACKING	24500	21000	28500				X					X						X				
MISS GINGER (VESSEL 2)	b82	SPARE	24500	21500	29000									X						X				
OI 3 (VESSEL 4)	b83	TRACKING	24500	22000	29500					X				X							X			
BOA SUB C (VESSEL 1)	b84	MILL 37 SPARE	24500	22500	30000						X			X								X		
SKANDI NEPTUNE (VESSEL 5)	b85	TRACKING	24500	23000	30500							X		X										
BOA SUB C (VESSEL 1)	b86	DP 2	24500	23500	27000									X			X							
MISS GINGER (VESSEL 2)	b87	SPARE	24500	24000	27500								X	X				X						

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Figure 11: HazID Rig Exposure to Oil Sheen or Plume Rig Operations

						Severity					Pre -Mitigation						Severity					Post -Mitigate							
Phase	Hazard	Hazard Scenario	Causes	Consequences	Safeguards	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Actions / Mitigation Measures	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Assigned Individual	Dates	Comments
						-	-	-	-								-	-	-	-									
Operating Rig	Oil Sheen	The results of the TOI internal HAZID were reviewed and accepted by the team. Included as a separate logsheet.				-	-	-	-							*No additional mitigations recommended.*	-	-	-	-									Note; the rig vessel master will have a conversation with the source vessels in field on their experience working the area with an oil sheen.
						-	-	-	-								-	-	-	-									Note: Vessels need a plan to flush ballast tanks prior to incident demobilization to remove any oily water in ballast tanks.
	Plume	Plume of concentrated oil comes up right under the rig.	Flow increases to a catastrophic rate. A potential cause, among others, could be failure of BOP stack.	environmental, financial.	Subsea visual, real time, monitoring of the well site area (three vessels with multiple ROV's). Existing TOI emergency procedures.	D	-	E	-	3	D3		E3			Develop a decision matrix for various scenarios of increased oil flow that could impact the drill rig.	E	-	E	-	3	E3		E3			George Gray		No
																Include in IAP that source control immediately communicates any flow changes to the SIMOPS Director											Troy Endicott		
																Develop a model to predict plume location based on subsea currents. Consider the impact of rapidly increasing flow rate.											Troy Endicott		Note: The rig response is partially based on having knowledge of expected plume location.
	Emulsion / Mousse					-	-	-	-							Determine the location and density of oil/water emulsion / mousse floating below the surface.	-	-	-	-							Troy Endicott		Note: The rig response is partially based on having knowledge of expected location of any emulsion/mousse.
						-	-	-	-							Convey IMT air monitoring and safety plan to the vessels.	-	-	-	-							Joe Neumeyer		
						-	-	-	-								-	-	-	-									

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Figure 12: HazID Rig Exposure to Oil Sheen or Plume Other Issues

						Severity				Pre -Mitigation							Severity				Post -Mitigate								
Phase	Hazard	Hazard Scenario	Causes	Consequences	Safeguards	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Actions/Mitigation Measures	Safety	Environmental	Financial	Reputation	Frequency	Safety	Environmental	Financial	Reputation	Risk	Assigned Individual	Dates	Comments
						-	-	-	-								-	-	-	-									
Moving to relief well sites	No unique hazards identified.				SIMOPS Plan is guidance document for green light to move in.	-	-	-	-								-	-	-	-									
					AUV survey to confirm no interferences at the relief well sites.	-	-	-	-								-	-	-	-									
Met ocean					Seasonably favorable winds and currents should keep slick away from rigs.	-	-	-	-								-	-	-	-									
					Historically loop currents move away from relief well drill locations. Loop currents are monitored daily.	-	-	-	-								-	-	-	-									
		Hurricane			Existing hurricane plans.	-	-	-	-								-	-	-	-							Troy Endicott		
Source Control vessels		Lose ROV and view of source			Three vessels with ROV's are onsite.	-	-	-	-								-	-	-	-									
						-	-	-	-								-	-	-	-									
		Acoustic conflict			SIMOPS plan defines resolution process.	-	-	-	-								-	-	-	-									
Vessels in 500 meter zone		Spill response vessels moving into the rig 500 meter zone			SIMOPS plan includes 500 meter zone requirement.	-	-	-	-							Send 500 meter zone to branch directors.	-	-	-	-							Troy Endicott		Note: The spill response vessels may be less familiar with the 500 meter zone practice. It is also in the SIMOPS Plan.
	Dead vessel	Vessel in the area has blackout	equipment failure	Potential vessel collision	SIMOPS plan includes 500 meter zone requirement.	-	-	-	-								-	-	-	-									
	NGO's, media				Vessel security plans, JIC (joint information center) to support communications.																								
		Oil washes on deck of supply boat going to the rig.			Supply boats avoid transit through oil slick if possible. They are offloaded on the lee side of the rig and have existing cleaning procedures. Note: the supply vessels have decon procedures for leaving the area.	-	-	-	-								-	-	-	-									
Dispersant Application					Rigs would have little if any exposure. Airspace is managed outside the rigs.											Communicate to the IMT the drill rigs request to maintain a minimum of one mile distance for dispersant application or in situ burning.											Troy Endicott		
In situ burn					Burning is not planned to be done close to the rigs.																								

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Figure 13: HazID Log Rig Exposure to Oil Sheen or Plume

HAZID Log

Node 1 : DDIII & DEN operating on Macondo (MC 252)

Operation	Hazard	Preventive Controls	Consequences	Mitigating Controls	Risk Ranking: Personnel	Risk Ranking: Loss of Containment	Risk Ranking: Property Damage	Risk Ranking: Risk	Additional Safeguards	Residual Risk: Personnel	Residual Risk: Loss of Containment	Residual Risk: Property Damage	Residual Risk: Risk	Comments
Operating rig with oil sheen present.	Oily water sucked up into thruster chiller units.	Ballast down as low as reasonably practicable. DDIII: Ballast down to Operating draft prior to moving onto MC 252. Take samples through strainers during rounds.	DEN: Overheating and going into power reduction mode. DDIII: Minimal exposure.	DEN: Continuously monitored. Can isolate 1 aft and 1 fwd while being serviced depending on the weather. DDIII: Continous monitoring. 2 independent loops w/ 3 heat exchangers each. Can put ones needing to be serviced on standby. Can monitor pressure & temperature differential via VMS. Can acid wash offline heat exchanger.			Ent B4 DD III B4							
	Oily water in heat exchangers (thruster motor, main engines, rig air compressor, thruster steering, thruster lube oil, AC units)	Ballast down as low as reasonably practicable. DDIII: Ballast down to Operating draft prior to moving onto MC 252. Take samples through strainers during rounds.	DEN: Overheating and potential engine shutdown. DDIII: Minimal exposure.	DEN: Continuously monitored. Has 2 SW cooled Heat Exchangers for Main Engines. 1 as spare, and 1 as backup. DDIII: Continous monitoring. 2 independent loops w/ 3 heat exchangers each. Can put ones needing to be serviced on standby. Can monitor pressure & temperature differential via VMS. Can acid wash offline heat exchanger.			Ent B4 DD III B4							
	Oily water in drawworks cooling unit.	Ballast down as low as reasonably practicable. DDIII: Ballast down to Operating draft prior to moving onto MC 252. Take samples through strainers during rounds.	Drawworks cooler unit overheating.	DDIII: 3 individual heat exchangers for Drill Floor equipment. Can take 1 offline to clean. DEN: Has 2 for DWX cooling. Can monitor and service while 1 offline.			Ent B4 DD III B4							

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7 References

7.1.1 BP

- MC-252 Incident Offshore Coordination SIMOPS Guidelines

7.1.2 Transocean (TOI)

- See TOI DEN and DD III HSE Plans
- TOI WSOC for DEN and DD III
- TOI Operations Manual
- TOI Floating Operations Manual HQS-OPS-004, Section 4, Subsection 11: DP Operations Guidelines – Close Proximity Operations.
- DEN DP Capability Plots
- Development Driller III DP Capability Plots

7.2 Other References

7.2.1 BP

- GoM MC-252 Incident Management of Change Plan
- BP GoM TOI HSE Management System Bridging Document
- Emergency Response Plan (ERP) Document Number: 1440-85-OP-PR-0005
- GoM Safe Practices Manual (SPM) – GoM Incident Notification, Reporting and Investigation Procedure. Document Number: CD # UPS-US-SW-GOM-HSE-DOC-00115-2
- GoM IMS Vol II – Regional Oil Spill Plan
- GoM IMS Vol III – Severe Weather Contingency Plan
- GoM Contract Aircraft Guidelines
- GoM Diving Procedures
- GoM Operational Guidelines for Offshore Support Vessels
- GoM DEN Operations Manual
- 500-m Zone Practice – BP Marine
- VOI – Vessel Operating Instructions – BP Marine
- Fan Beam User Manual v. 4.1
- DMAC (Diving Medical Advisory Council) dated 1979

Appendix A: Contact Details – MC-252 Incident

Name	Telephone	E-Mail	Title
Emergencies and Regulatory			
Terrebonne General Medical Center 8166 Main Str. Houma	(985) 873-4141 Oper. (985) 873-4150 Emerg.		
US Coast Guard	(504) 589-6225 (985) 380-5320		
Houston Crisis Center **BP ICP – 24 Hour Number**	**(281) 366-0286 O** **(713) 208-6173 C** **(800) 321-8642** **(630) 961-6200**		
MMS Houma District MMS Pipeline Section	(985) 853-5884 O (985) 879-2738 F (985) 688-6050 C (504) 736-2814 O (504) 736-2408 F (504) 452-3562 C		
Douglas, Scherie	(281) 366-6843 O (713) 702-7673 C	Scherie.douglas@bp.com	Sr. Regulatory & Advocacy Advisor
SIMOPS Director			
Endicott, troy	(281) 366-7687 O (713) 409-0061 C	Troy.endicott@bp.com	Deputy Marine Authority
Oil Spill Response Command			
Smith, Stephen (O'Brian Group)	(866) 215-4586 (866) 292-1326	mops.lar.master@msrc.org smiths3663@hotmail.com	Oil Spill Response On-Scene SIMOPS Coordinator (onboard Louisiana Responder 866-292-1326)
Source Control Vessel Command			
Sepulvado, Murry	(318) 471-1763	sepulvmr@bp.com	Source Control
TOI Discoverer Enterprise			
Captain OIM Bridge / DPO Radio room BP WSL BP Clerk / dispatch BP Subsea	(832)-587-5530/5 (713) 587-5531 713-232-8245 ext. 2008 or 2007 (713) 232-8245 (281) 366-4504 or (281) 366-4506 (281) 366-4515 (281) 366-4536	captain.den@deepwater.com Oim.den@deepwater.com dpoperator.den@deepwater.com Sat Telephone Bridge (voice): 0-11-870-353-830-551 Sat Telephone Radio Room (voice): 0-11-870-353-830-550 Iridium Sat Phone: 1-480-768-2500 code 8815-4147-9794 Radio Frequency Ch 12 VHF (MHz) - 156.650	

Name	Telephone	E-Mail	Title
Port and Stb. ROV	(713) 232-8245 ext. 2229	Radio Frequency Ch 16 VHF (MHz) - 156.800 Helicopter VHF (MHz) – 123.050 Call Sign V7HD3	
TOI Development Driller III			
DD III Well Site Leader Radio Rm. DD III Inmar Sat DPO Captain BP Dispatcher	**713-336-8218** 832-587-6871 Dial 0 for operator 011 870 764449920 x-203 and x-204 x-206 713-336-8215 713-336-8229 713-336-8201	dd3wellsiteleader@bp.com dpoperator.dd3@deepwater.com mil80@oceaneering.com Mil14@oceaneering.com	
BP Discoverer Enterprise and DD III Houston Leadership			
Gray, George	(281) 366-0659 O (713) 376-1099 C	George.gray@bp.com	DD III Team Leader
Halvorson Dory, Kathleen	(281) 366-2626 O (713) 206-5339 C	Kathleen.dory@bp.com	Drilling Engineer DEN
Jacobsen Plutt, Louise	(281) 366-5932 O (281) 685-2017 C	Louise.jacobsenplutt@bp.com	Drilling Engineer DD III
Stoltz, Dan	(281) 366-3424 O (713) 805-9972 C	Dan.stoltz@bp.com	DEN Team Leader
TOI Rig Support			
Brekke, Jim	(281) 925-6676 O (281) 961-1368 C	jim.brekke@deepwater.com	Manager Marine Technology
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Updated April 28, 2010			

SMART Tier 1 overflight report for 26Apr10

Prepared by Jim Jeansonne, NOAA, observer. The second observer was Jeremy Oneal, USCG PAC.

Departed Houma at 1016, arrived in oil dispersant area around 1100. Two dispersant aircraft had been dispersing prior to our arrival and were still spraying. This area was around N28-44.743, W88-08.190.

The oil being sprayed was long windrows of emulsified oil (bright orange) and we observed some effectiveness as evidenced by the tan clouds of dispersed oil forming in the path of the spraying. Images 11, 12, 28, 29, 32 and 34 were taken in this area.

After refueling at a platform (BP Marlin, VK915 at N29-06.475, W87-56.572) about 45 mile to the NE, we then monitored spraying around the source. Aircraft were spraying areas of dark brown oil (fresh oil surfacing) 80-100% coverage. Again, we observed clouds of tan dispersed oil forming in 15-30 minutes after being sprayed. Images 54, 55, 57, 63, 64, 77 and 80 were taken in this area.

Photos and flight track are available and linked, and will be loaded into R-L.

Our altitude for both areas during observation was mostly between 500-1000'

Although we all (pilots and observers) looked for marine mammals in all areas flown, none were observed.

We departed the source area for Houma at 1338, arriving at Houma at 1445.

Using EK60 to assess acoustic abundance of marine organisms in the water column

We propose to study the distribution and abundance of marine organisms in the water column as part of the damage assessments that are being conducted in the Gulf of Mexico to assess the negative effects of the Deepwater BP Oil Spill.

This study will help to determine the distribution of acoustic backscatter relative to the footprint of the oil spill and to evaluate the potential effects of the use of dispersants as this get mixed in the upper water column.

We will measure acoustic signals (to estimate biomass of krill-like and forage fish-like organisms). We will integrate this information with other measures of physical oceanographic parameters (ocean conditions, nutrients), measures phytoplankton standing stock (to calibrate fluorescence measurements), sample the overall zooplankton community (to identify indicator species), and counts of marine bird and mammal community.

1) Krill-like biomass and net sampling

We will use acoustic methods to obtain vertical and horizontal distributions and net sampling to confirm the identity, size classes and sexual maturity of krill located acoustically. Acoustic techniques are recognized as a tool for the detection and quantification of euphausiids (Cockrane et al. 1991, Coyle et al. 1992, Coyle and Cooney 1993). Though a featured component of the U.S. Antarctic program (www.ccamlr.org), this technique has received criticism, especially when used without net sampling. Therefore, our approach is to combine acoustic and net sampling procedures. We will sample the distribution of euphausiids using a multi-beam hull-mounted SIMRAD EK-60 Echosounder, equipped with 38, 120 and 200 kHz transducers. The echosounder will be calibrated twice-yearly using standard sphere procedures (Johannesson and Mitson 1983, Traynor and Ehrenberg, 1990). GPS-tagged raw EK-60 ping data will be logged to disk for post-cruise analysis.

Differences in volume backscattering (Sv) measured at multiple frequencies will be used to classify acoustic targets. To eliminate noise from the data (e..g, non-biological echos from the bottom and/or bubbles), we will exclude acoustic backscatter at a threshold of -81 dB (Cockrane et al. 1991, Coyle et al. 1992, Coyle and Cooney 1993, Croll et al. 1998). Sound scattering by euphausiids (size 10-30 mm) produces Rayleigh scattering at 38 kHz, causing little backscatter, whilst these animals reflect and produce high acoustic backscatter at 120 and 200 kHz (Fiedler et al. 1998). The difference in Sv between multiple frequencies, along with visual inspection of the scattering layers and targeted net tows, can be used to distinguish euphausiids from other scatterers. We will begin with the relationship [$\Delta Sv = 0.5(Sv_{120} + Sv_{200}) - Sv_{38}$] used by Fiedler et al. (1998) to define euphausiid scattering layers, and then work to further refine the relationship to animals in the study area through our net-sampling efforts (see below). Euphausiid abundance will be averaged over the depth range and horizontal intervals of interest for analysis and plotting.

We will estimate euphausiid biomass along survey transects using methods for acoustic biomass estimation from Hewitt et al. (2002) and Demer and Conti (2005). Echograms will be gridded and integrated in regions identified as krill using Echoview software (Sonardata Pty.

Ltd.). Time-varying "noise" will be subtracted, and the resulting backscatter will be multiplied with a target strength (TS) model in order to derive euphausiid biomass. The most detailed euphausiid TS models incorporate probabilities to describe length-weight relationships, average body angle, and other species-specific attributes (Demer and Conti 2005). Many of these parameters have not yet been determined for our study species. Therefore, as part of this project we will develop a TS model; we will build upon the results of Green et al. (1988, 1989), and will model TS using data from our Tucker trawls (see below). Providing that a comparison of volume scattering and TS (net) data indicate little net avoidance, we will estimate biomass directly from by linear regression, using volume backscatter and species-specific biomass from net samples as parameters (Pieper 1979, 1983),

A net-sampling effort will be critical for (i) ground-truthing acoustic signatures of "apparent" krill, (ii) deriving krill age/size structure and body measurements for TS and biomass equations, and (iii) description of the zooplankton community in general. We will sample euphausiids and other zooplankton using a 1-m^2 Tucker trawl equipped with three 333-µm mesh nets; we will tow at 2.5 knots. A messenger-release mechanism will allow us to target specific layers, while being guided by acoustics. For ΔSv to be converted to euphausiid biomass, net sampling needs to be controlled well enough to precisely match net catches to observed backscatter in targeted patches or layers of high backscatter (Fiedler et al. 1998). To ensure that the net and acoustic data sets are matched as accurately as possible in space and time, GPS position and time data from the ship's navigation system will be written to each acoustic and net sampling data record. There will be a depth profiler attached to the frame of the net to track the position of the net relative to the acoustics, and *General Oceanics* digital flowmeters will measure the volume of seawater sampled. Net samples will be collected at the shelf break in each oceanographic line and in areas where high acoustic backscatter is recorded. Day and night time net sampling may reveal different patterns in krill due to vertical migration; we will target acoustic layers during the day. Large gelatinous zooplankton will be removed from the samples and discarded. The rest of the material will be preserved in 10% formalin and stored until processing. Processing will involve two procedures, one to sort euphausiids and one to process the entire sample for the analysis of community structure. Euphausiid material will be sub-sampled, then sorted, identified, counted, and weighed; length will be measured. Euphausiids will be classified following Kathman et al. (1986).

2) Forage fish-like biomass

We will use hydroacoustic surveys to estimate forage fish biomass (Watkins & Brierley 1996, Horne & Clay 1998). Fish avoids nets making it difficult to determine the composition of acoustic biomass with net sampling especially during the day time. Therefore, descriptions of the local fish community and size and composition of fish captured during the Rockfish Cruise (NMFS) will be used to determine appropriate target strengths. Iinformation on local bird diets suggest fish have acoustic signals greater than –60 dB (decibels) (Vlietstra 2005, Morejohn et al. 1978, Caillet et al. 1979, Ainley et al. 1981, 1996, Croll 1989, H. Nevins unpubl. data). As most euphausiids have low target strengths (TS < –70 dB animal–1 at 120 kHz frequency) relative to fish and squid (TS > –55 dB animal– 1), removing backscatter below –60 dB should exclud most plankton, leaving acoustic biomass pertaining to fish with swim bladders (Vlietstra 2005, Pieper 1979, Vaughan & Recksiek 1979, Barange et al. 1996, Misund & Beltestad 1996, Brierley et al. 1998, McGehee et al. 1998, Kawabata 1999, Coyle & Pinchuk 2002).

3) Physical oceanography

We will collect continuous underway data and vertical profiles at stations to determine horizontal and vertical gradients in water properties and flow. Continuous underway data on near surface temperature, salinity, and fluorescence will be sampled using a Sea-Bird Electronics SBE*21* SEACAT thermosalinograph and a WET Labs fluorometer installed in the sea-chest of the ship. Conductivity-Temperature-Depth (CTD) vertical profiles will be sampled by deploying a Sea-Bird Electronics SBE 19*Plus* SEACAT Profiler equipped with a WET Labs WETStar fluorometer to 200-m (or within 10-m of the seafloor if the seafloor is less than 200-m) at predetermined locations along oceanographic lines (Fig. 1). We will use SBE Data Processing Software from Sea-Bird Electronics Inc., Bellevue, Washington to process and bin downcast data to 1-m depth intervals.

Further, ongoing analysis of oceanographic data from a major NOAA-funded study (WEST) will be combined to obtain a mechanistic understanding of oceanographic structures for which krill exhibit affinities: (i) the upwelling plume extending south from Pt Arena; (ii) a shear zone where upwelling flow separates from the coast near Pt Reyes; and (iii) wake, cones, and other sub-surface flow features associated with Cordell seamount and adjacent canyons. Surface HF-radar data from WEST will be used to determine pathways along which surface waters are advected from Pt Arena/Reyes upwelling centers to Cordell Bank/Farallon Archipelago, and a combination of survey and satellite data will be used to assess phytoplankton food content south of Cordell Bank.

4) Marine bird and mammal community

We will use standardized strip and line transect survey methods to determine the distribution and abundance of marine birds and mammals. Marine bird and mammal distribution, densities, and behavior will be recorded along transects. Counts of birds and mammals will be made from the flying bridge of the ship while underway at ~10 knots. Birds will be counted continuously in a 100-m arc from directly ahead of the vessel to 90º off the side with the best visibility (least glare). Mammals will be counted continuously by scanning to the horizon directly ahead of the vessel to 90º off both sides; distances to mammals will be estimated using range-finding binoculars. A continuous count of flying seabirds (as opposed to a “snap shot method”) may overestimate densities of birds in the region (van Franeker 1994), but provides an estimate of flux through the region (Hunt *et al.* 1994). Flying birds may also have recently been feeding. Therefore, we will use the “continuous” method. Seabird behaviors will be recorded as flying (with flight direction), sitting on the water, and feeding. For our analyses of predator-prey distributions, we will focus on birds actively foraging and/or sitting on the water. We define feeding birds as those observed plunging at sharp angles into the water, or involved in pursuit-diving from the surface. For the purpose of this analysis, we will assume that birds sitting on the water have recently fed in the vicinity. Although euphausiids exhibit diel migration, daytime surveys have been used to detect euphausiid – seabird spatial associations in the Bering Sea (Hunt et al. 1996) and elsewhere in the California Current (Ainley et al. 2005).

References:

Ainley DG, Anderson DW, Kelly PR (1981) Feeding ecology of marine cormorants in southwestern North America. Condor 83:120–131

Ainley DG, Spear LB, Allen SG, Ribic CA (1996) Temporal and spatial patterns in the diet of the common murre in California waters. Condor 98:691–705

Ainley DG, Spear LB, Tynan CT, Barth JA, Pierce SD, Ford RG, Cowles TJ (2005) Physical and biological variables affecting seabird distributions during the upwelling season of the northern California Current. Deep Sea Research Part II: Topical Studies in Oceanography 52:123-143

Barange M, Hampton I, Soule M (1996) Empirical determination of in situ target strengths of three loosely aggregated pelagic fish species. ICES J Mar Sci 53:225–232

Brierley AS, Ward P, Watkins JL, Goss C (1998) Acoustic discrimination of Southern Ocean zooplankton. Deep-Sea Res II 45:1155–1173

Cailliet GM, Karpov KA, Ambrose DA (1979) Pelagic assemblages as determined from purse seine and large midwater trawl catches in Monterey Bay and their affinities with the market squid, Loligo opalescens. CalCOFI Rep 20: 21–30

Cockrane, NA, Sameoto, D, Herman, AW, Neilson, J (1991) Multiple-frequency acoustic backscattering and zooplankton aggregations in the inner Scotian shelf basins. Can. J. Fish. Aquat. Sci., 48: 340-355

Coyle, KO, Cooney, RT (1993) Water column sound scattering and hydrography around the Pribilof Islands, Bering Sea. Cont. Shelf Res. 13: 803-827

Coyle, KO, Hunt, GL, Jr., Decker, MB, Weingartner, TJ (1992) Murre foraging, epibenthic sound scattering and tidal advection over a shoal near St. George Island, Bering Sea. Mar. Ecol. Prog. Ser. 83: 1-14

Croll DA (1989) Determinants of the diet and distribution of the common murre (Uria aalge) in Monterey Bay, California. MSc thesis, California State University, Fresno, CA

Croll DA, Marinovic B, Benson S, Chavez FP, Black N, Ternullo R, Tershy BR (2005) From wind to whales: trophic links in a coastal upwelling system. Mar Ecol Prog Ser 289:117–130

Demer DA, Conti SG (2005) New target-strength model indicates more krill in the Southern Ocean. ICES Journal of Marine Science 62:25-32 Dorman JG, Bollens SM, Slaughter AM (2005) Population biology of euphausiids off northern California and effects of short time-scale wind events on Euphausia pacifica. Mar Ecol Prog Ser 288:183–198

Fiedler PC, Reilly SB, Hewitt RP, Demer D, Philbrick VA, Smith S, Armstrong W, Croll DA, Tershy BR, Mate BR (1998) Blue whale habitat and prey in the California Channel Islands. Deep Sea Research Part II: Topical Studies in Oceanography 45:1781-1801

Greene, CH, Wiebe, PH, Burczynski, J, Yougbluth, MJ (1988) Acoustic detection of high-density krill demersal layers in the submarine canyons off Georges Bank. Science 241:359-361

Greene, CH, Wiebe, PH, Burczynski, J. (1989) Analyzing zooplankton size distribution using high-frequency sound. Limnol. Oceanogr. 34:163-178

Hewitt, RP, Watkins, JL, Naganobu, M, Tshernyshkov, AS, Brierley, AS, Demer, DA, Kasatkina, S, Takao, Y, Goss, C, Malyshko, A, Brandon, MA, Kawaguchi, S, Siegel, V, Trathan, PN, Emery, JH, Everson, I, Miller, DGM (2002). Setting a precautionary catch limit for Antarctic krill. Oceanogr., 15, 26–33

Horne J, Clay CS (1998) Sonar systems and aquatic organisms: matching equipment and model parameters. Can J Fish Aquat Sci 55:1296–1306

Hunt GL, Jr., Coyle KO, Hoffman S, Decker MB, Flint EN (1996) Foraging ecology of short-tailed shearwaters near the Pribilof Islands, Bering Sea. Mar. Ecol. Prog. Ser. 141:1-11

Hunt, GL, Jr., Croxall, JP, Trathan, PN (1994) Marine Ornithology in the southern Drake Passage and Bransfield Strait during the BIOMASS Programme. Pp. 231-245 in S.Z. El-Sayed, ed. Southern Ocean Ecology: The BIOMASS perspective. Cambridge U. Press.

Johannesson, KA, Mitson, RB (1983) Fisheries acoustics: a practical manual for aquatic biomass estimation. FAO Fisheries Technical Paper. 240:249

Kathman, RD, Austin, WC, Saltman, JC, Fulton, JD (1986) Identification manual to the Mysidacea and Euphausiacea of the northeast Pacific. Dept. Fisheries and Oceans, Ottawa, 411 p.

Kawabata A (1999) Measurement of the target strength of Japanese flying squid, Todarodes pacificus Steenstrup. Bull Tohoku Nat Fish Res Inst 61:29–40

McGegee DE, O'Driscoll RL, Traykovski LV (1998) Effects of orientation on acoustic scattering from Antarctic krill at 120 kHz. Deep-Sea Res II 45:1273–1294

Misund OA, Beltestad AK (1996) Target-strength estimates of schooling herring and mackerel using the comparison methods. ICES J Mar Sci 53:281–284

Morejohn GV, Harvey JT, Kransnow LT (1978) The importance of Loligo opalescens in the food web of marine vertebrates in Monterey Bay, California. In: Recksiek CW, Frey HW (eds) Biological, oceanographic, and acoustic aspects of the market squid, Loligo opalescens Berry. Calif Dep Fish Game Game Bull 169:67–185

Pieper, RE (1979) Euphausiid distribution and biomass determined acoustically at 102 kHz. Deep-Sea Res. 26/6A: 687-702

Pieper, RE (1983) Quantitative estimates of euphausiid biomass determined by high-frequency acoustics. Biological Oceanography, 2: 133-149

Traynor, JJ, Ehrenberg, JE (1990) Fish and standard-sphere target-strength measurements obtained with a dual-beam and split-beam echo-sounding system. Tapp. P.-v. Reun. Cons. int. Explor. Mer. 189: 325-335

Van Franeker, JA (1994) A comparison of methods for counting seabirds at sea in the Southern Ocean. J. Field Ornithol. 65: 96-108

Vaughan DL, Recksiek CW (1979) Detection of market squid, Loligo opalescens, with echo sounders. CalCOFI Rep 20: 40–50

Vlietstra, LS (2005) Spatial associations between seabirds and prey: effects of large-scale prey abundance on small scale seabird distribution. Mar Ecol Prog Ser 291: 275–287

Watkins JL, Brierley AS (1996) A post-processing technique to remove background noise from echo integration data. ICES J Mar Sci 53:339–344

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Date: Wed, 11 Aug 2010 14:31:20 -0500
To: Ian Zelo
CC: Alyce Fritz , Amy Merten , Anthony Dvarskas , Benjamin Shorr , Branden S Blum , Brendan Bray , Brian Hostetter , Charlene Andrade , Cheryl Brodnax , Chris Doley , Christopher Plaisted , Courtney Groeneveld , Craig R O'Connor , Dan Rutz , Daniel Hahn , Daphne Macfarlan , David Witting , Dolores Toscano , Gabrielle Dorr , Gail E Siani , George Graettinger , Greg Baker , Gwendolyn McCarthy , Jack Terrill , James G Turek , Jay Field , Jean Cowan , Jeff Shenot , Jennifer Boyce , Jessica White , Jessica Winter , Jill Bodnar , Joe Inslee , John Cubit , John Iliff , John Kern , John Rapp , Kate Barfield , Kate Clark , Katherine Pease , Ken Finkelstein , Kevin Kirsch mich , Kristopher Benson , Laurie Lee , Laurie Sullivan , Leslie Craig , Linda B Burlington , Lisa Dipinto , Lisa Pelstring , Lisa Rosman , Lynne Barre , Marguerite Matera , Marie Bundy , Marjorie Sams , Marla Steinhoff , Marti McGuire , Mary Baker , MaryElliott Rolle , Michael Greer , Michel Gielazyn , Michele Jacobi , Nancy A Berube , Nancy Beckvar , Natalie C-Manning , Norman Meade , Peter Knight , Rebecca Hoff , Reyhan Mehran , Rob Ricker , Robert A Taylor , Robert Haddad , Robert Neely , Robert Wolotira , Scott Hecht , Sean Meehan , Sheila O'Brien , Simeon Hahn , Stephanie Willis , Terri Lewis , Todd Goeks , Tom Brosnan , Tom Dillon , Tom Moore , Tony Penn , Tracy Minick , Troy Baker , Whitley Saumweber , John Whitney

Folks, Sorry for the delay but here is the information on the talk this afternoon.
IZ

Greetings,
There was a request for a repeat of the subsurface oil discussion from last week. We are going to do that today at 1600 CDT. We will be using the following webex and conference call numbers. I am not sure who all was requesting the repeat, please forward if appropriate.
Debbie

CALL IN INFORMATION: [redacted] - Passcode[redacted] B6 Privacy

WEBINAR INFORMATION:

Meeting Date: 081110

Meeting Time: 4:00 PM CENTRAL TIME

Instant Net Conference Details:

Meeting Number: 744613511
Meeting Passcode:
Meeting Host: MARK MILLER

Join Instructions for Instant Net Conference:

1. Join the meeting now:
http://www.mymeetings.com/nc/join.php?sigKey=mymeetings&i=744613511&p=&t=c
2. Enter the required fields.
3. Indicate that you have read the Privacy Policy.
4. Click on Proceed.

Note: When you click on the weblink the seattle screen will show up. If you haven't used webinar before

and would like to make sure your system can access it, the webinar it will be activated at 1530 CDT. Discussion will be at 1600 CDT.

On 8/10/2010 10:43 AM, Ian Zelo wrote:

> Folks,
> I will bring this up again on the call tonight but I wanted to get the word out a little earlier so that people had time to adapt their schedules etc. The story in a nutshell is that ERD put on a short (<1 hour) presentation about deep sea releases and dispersant etc. It was very informative and there were a number of people who were interested in hearing it.
>
> I have talked to Bob Pavia and it looks like we are on for Tomorrow at 1600 Central. We'll get call in / webinar info out.
>
> Hope you all can make it.
>
> IZ
>
> John Whitney / Bob - can you get this out to the ERD side of the house for those who missed it before?

--
==

Ian Zelo
Oil Spill Coordinator
NOAA - Assessment and Restoration Division
7600 Sand Point Way NE
Seattle, WA 98115
[redacted] (cell - Emergencies Only)
(fax)
ian.j.zelo@noaa.gov
----
http://response.restoration.noaa.gov/

Received(Date): Fri, 14 May 2010 23:05:08 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update: May 14, 2010
Slide Pack 5-14-10.ZIP

In addition to today's update (below) you will find attached a slide deck which highlights the subsurface options currently being considered and deployed.

Please let me know if you have questions.

Gulf of Mexico Oil Spill Response Update

05/14/2010 – 3:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;

2. On the Surface to minimize impacts of the spill; and

3. Onshore to protect the shoreline and keep the public informed.

Highlights

ξ 17,444 personnel responding as part of the Command, plus volunteers.

ξ Training expanded, more than 10,000 volunteers trained this week.

ξ Riser insertion tool ready for placement into the end of the leaking riser pipe.

ξ Relief well at 9,000 feet – running riser to continue drilling.

ξ 2 new claims offices open in Florida and 1 in Louisiana.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts. 4 vessels and 9 Remote-Operated Vehicles continue subsea work on the following operations:

1. **Riser Insertion Tube** – A tool has been fabricated and lowered to the sea floor. One end will be attached to the riser and drill pipe which run to the Transocean *Enterprise*, on the surface. The other end will be inserted into the ruptured riser pipe that is the primary source of the leak. All necessary equipment is on location and engineers plan to move them into place Friday night.

2. **Containment Recovery System**

ξ A containment dome, called a "top hat," has been deployed to the sea floor and is being readied to be placed over the main leak, if needed. It is designed with injection ports that can accommodate "anti-freeze" in order to mitigate the formation of frozen hydrates.

ξ It is important to note that this technology has never been done at this water depth. Significant technical and operational challenges must be overcome for it to be successful.

3. **"Top Kill" Activities**– Equipment has been fabricated and moved to location near the blowout preventer in order to work on killing the well from the top. Manifold and bypass lines are in place to provide access to valves on the BOP. A "junk shot" of shredded fibrous material will be injected into the BOP through these lines. The objective is for the material to travel up the BOP and clog the flow of the well at the pinch point. Once the pressure is controlled, heavy fluids and cement will be pumped down the well to kill it. This procedure is ongoing.

4. **Drilling relief wells** – Transocean *Development Driller III* "spudded" the first relief well on Sunday, May 2 in a water depth of roughly 5,000 feet. This relief well is one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below sea level. As of today, the well has been drilled to 9,000 feet below sea level. Casing was run and cemented to that depth. The BOP is tested and riser is being run so drilling can continue, sometime this weekend. It is estimated the total drilling process will take at least 90 days. Once that is accomplished, heavy fluids and cement can be pumped downhole to kill the well. A second relief well has been permitted and the Transocean *Development Driller II* is on location with drilling expected to begin on May 16.

5. **Dispersant injection at the sea floor** – BP has conducted a third round of injecting dispersant directly at the leak site on the sea floor using Remote Operated Vehicles (ROVs). Dispersant acts by separating the oil into small droplets that can break down more easily through natural processes before it reaches the surface. Sonar testing and aerial photographs show encouraging results. The Environmental Protection Agency and other state and federal agencies, operating as part of the National Response Team, have approved additional subsea application subject to ongoing protocols.

Offshore – Surface Spill Response

ξ **Cleanup Vessels** – 559 specialty response vessels are deployed, including tugs, barges and

recovery boats. 30 of the boats are Oil Spill Response Vessels that are designed to separate the oil from water. Approximately 151,391 barrels of oil-water mix (6.35 million gallons) have been recovered and treated, a reported increase of nearly 50,000 barrels since Wednesday.

- **Surface Dispersant** – 517,577 gallons of dispersant have been applied on the surface by aircraft. The dispersant is a biodegradable chemical that works like soap by separating the oil into small droplets that can be more easily broken down by natural processes. An additional 258,000 gallons are available for deployment. The Unified Command has three teams of vessels in place to apply dispersant on the surface, weather permitting.

- **In-Situ Burning** – The Unified Command has teams in place prepared to continue in-situ burning,depending on the weather. The in-situ burning is conducted on the surface using special fire-boom that collects surface hydrocarbons which are then burned off.

Onshore - Shoreline Protection and Community Outreach

- **$25 Million Block Grants to 4 States** – Louisiana, Florida, Mississippi and Alabama have each received a $25 million block grant. The grants were offered by BP to help local agencies upfront to implement the States' approved Area Contingency Plans. The Contingency Plans address removal of a worst case spill and are designed to mitigate or prevent a substantial threat to sensitive areas. The money will enable local businesses to immediately support clean-up and recovery efforts. The grant is supplemental to BP's private claims process, which remains unchanged

- **Oil Containment and Shoreline Protection** – More than 1,600,000 feet of both sorbent and barrier boom have been deployed or staged to protect sensitive coastal areas. BP is working to procure an additional 3,500,000 feet of boom. Boom is now in place to protect nearly all "Tier 1" shoreline in each of the four states, and teams are now working on "Tier 2" areas.

- **"Vessels of Opportunity" Program**– Nearly 3,200 applications have been approved and approximately 1,150 vessels are active – an increase of 450 since Wednesday. Participating vessels are being organized into 25-boat task force teams to help with a variety of clean-up activities, including transporting supplies, performing wildlife rescue, and towing and deploying booms. To qualify for the program, operators need to meet several key requirements, including attending a four-hour hazardous waste training session, passing a dockside examination by the U.S. Coast Guard, and meeting crewing requirements based on the size of the vessel provided. The contact number for people interested in registering for the program is (281) 366-5511. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers." For additional information about training call (866) 905-4492.

- **Volunteers and Training** – BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Training ramped up significantly this week, with sessions held at multiple locations across

the Gulf. As of today, more than 15,000 volunteers have been trained in five different training modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. This is an increase of more than 10,000 for the week. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

ξ **Informing Community Leaders** – The Unified Command is currently holding twice-daily teleconferences with mayors and community leaders across Mississippi, Alabama and Florida to ensure that elected officials have an opportunity to be updated on Command activities and to ask questions. Additionally, BP has deployed local government affairs specialists to respond directly to local governments.

ξ **Wildlife Activities** – 2 additional reports of impacted wildlife. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

ξ **Claims for Damages** - BP has opened 12 claims offices to help claimants through the process. Vietnamese and Spanish translators are in some offices. 10,500 claims have been filed and 2,200 of them have been paid--doubling the amount of claims paid since Wednesday. The contact number for claims is (800) 440-0858. Claims office locations are listed below.

Summary of Regional Operations and Outreach

Robert – Unified Area Command

Louisiana Sites:

Houma – Incident Command Post

Pointe A La Hache – Community Outreach Center

Venice – Community Outreach Center, Staging Area

Grand Isle – Staging Area

Port Fourchon – Staging Area

Cocodrie – Staging Area

Shell Beach – Staging Area

Slidell – Staging Area

Amelia – Staging Area

Belle Chasse – Claims Office

2766 Belle Chasse Hwy

Belle Chasse, LA 70037

Grand Isle – Claims Office

3811 LA 1

Grand Isle, LA 70358

Hammond – Claims Office

Worley Operations Center

303 Timber Creek

Hammond, LA 70404
Pointe A La Hache – Claims Office

1553 Hwy 15

Pointe A La Hache, LA
St. Bernard – Claims Office

1345 Bayou Rd

Saint Bernard, LA 70085
Venice – Claims Office

41093 Hwy LA 23

Boothville, LA 70038

ξ Bringing in additional adjusters to help process claims and working with translators to ensure that Vietnamese and Spanish speaking communities are served.

ξ Continued work with parish presidents and opening new community outreach centers. Helping communities deal with increased traffic due to media and governmental interest.

ξ Working with Catholic Charities to assist with immediate community needs of food and clothing.

Mississippi Sites: Pascagoula – Community Outreach Center, Staging Area
Biloxi – Community Outreach Center, Staging Area
Waveland – Community Outreach Center
Pass Christian – Staging Area
Biloxi – Claims Office

920 Cedar Lake Rd, Suite K

Biloxi, MS 39532
Pascagoula – Claims Office

5912 Old Mobile Hwy

Suite 4

Pascagoula, MS 39563

ξ Community outreach centers are now in all three coastal counties.

ξ Continuing to coordinate training for vessel operators and working through Vessels of Opportunity contracts.

ξ No oil has been reported in Mississippi state waters.

Alabama Sites: Mobile – Incident Command Post, Community Outreach Center
Theodore – Staging Area
Orange Beach – Staging Area
Dauphin – Staging Area
Bayou LaBatre – Claims Office

290 N. Wintzell Avenue

Bayou LaBatre, AL 36509
Foley – Claims Office

(Orange Beach/Gulf Shores/Bon Secour)

1506 North McKenzie Street (HWY 59),

Suite 104

Foley, AL 36535

ξ Staffing claims centers with adjusters to process claims.

ξ Working with Governor's office and non profit organizations to coordinate volunteers and identify volunteer opportunities.

ξ Collected tarballs on Dauphin Island -- analyzing source.

Florida Sites: St. Petersburg – Incident Command Post
Pensacola – Community Outreach Center, Staging Area
Panama City – Staging Area
Gulf Breeze – Claims Office

5668 Gulf Breeze Pkwy

Unit B-9

Gulf

Breeze,
FL 32563

Pensacola – Claims Office

3960 Navy Boulevard

Suite 16-17

Pensacola, FL 32507

ξ Holding townhall meetings with vessel owners and coordinating training for Vessels of Opportunity volunteers.

ξ Working with counties to engage volunteers in additional beach clean ups.

ξ Engaged eight Gulf coast counties with outreach coordinators, government affairs specialists, and training providers.

Contact Information

Environment / Community Hotline – to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife – to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers – to request volunteer information	(866) 448-5816
Services – to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity – to report and register boats available to assist with response	(281) 366-5511
Training – for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit – email suggestions to horizonresponse@piersystem.com	
Investor Relations	(281) 366-3123
Claims	(800) 440-0858
Joint Information Center – Media and governmental inquiries	(985) 902-5231 or (985) 902-5240
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765
BP Family – and third-party contractor hotline	(281) 366-5578
Twitter: Oil_Spill_2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

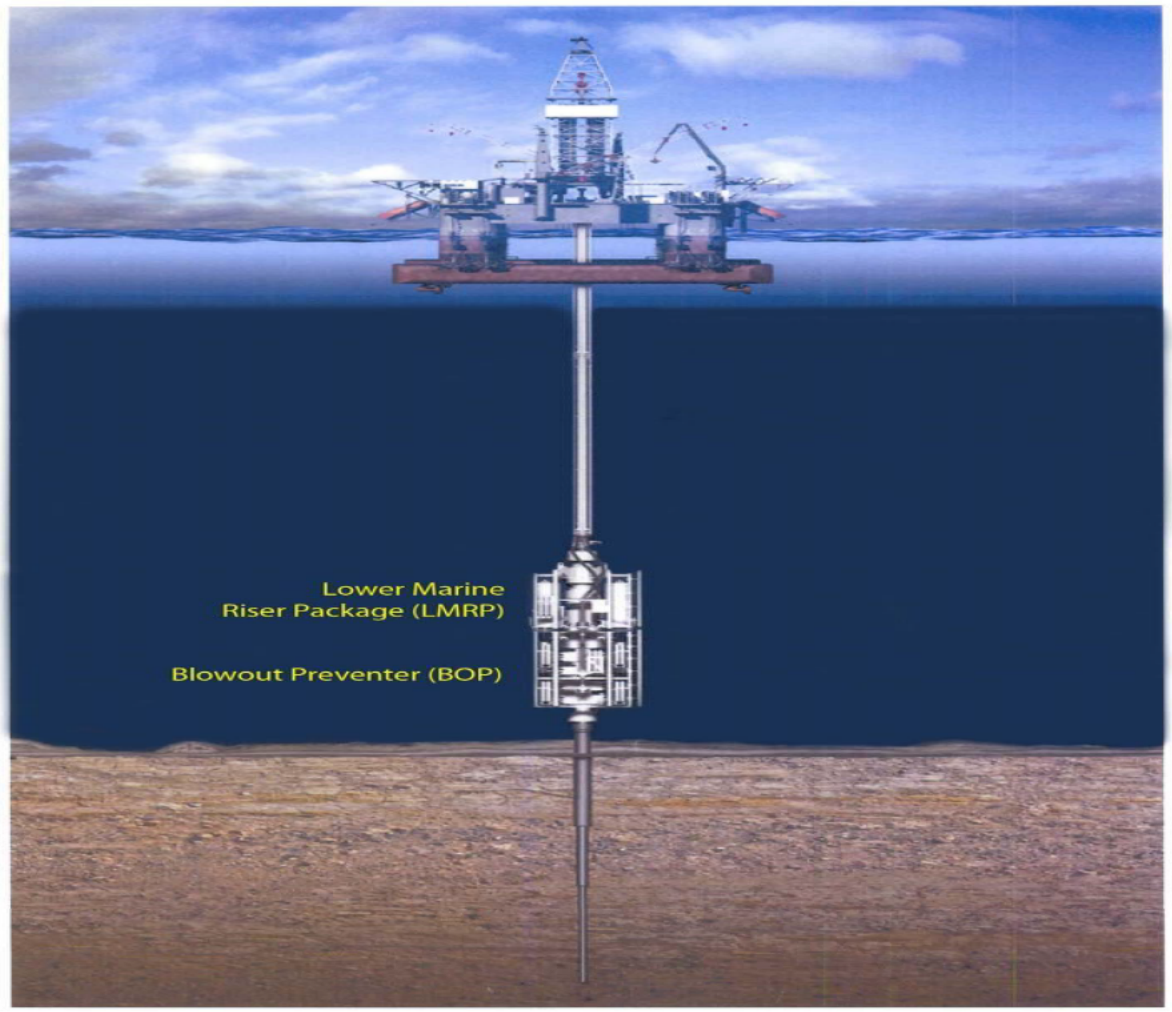
BP America

Sr. Director, Regulatory Affairs

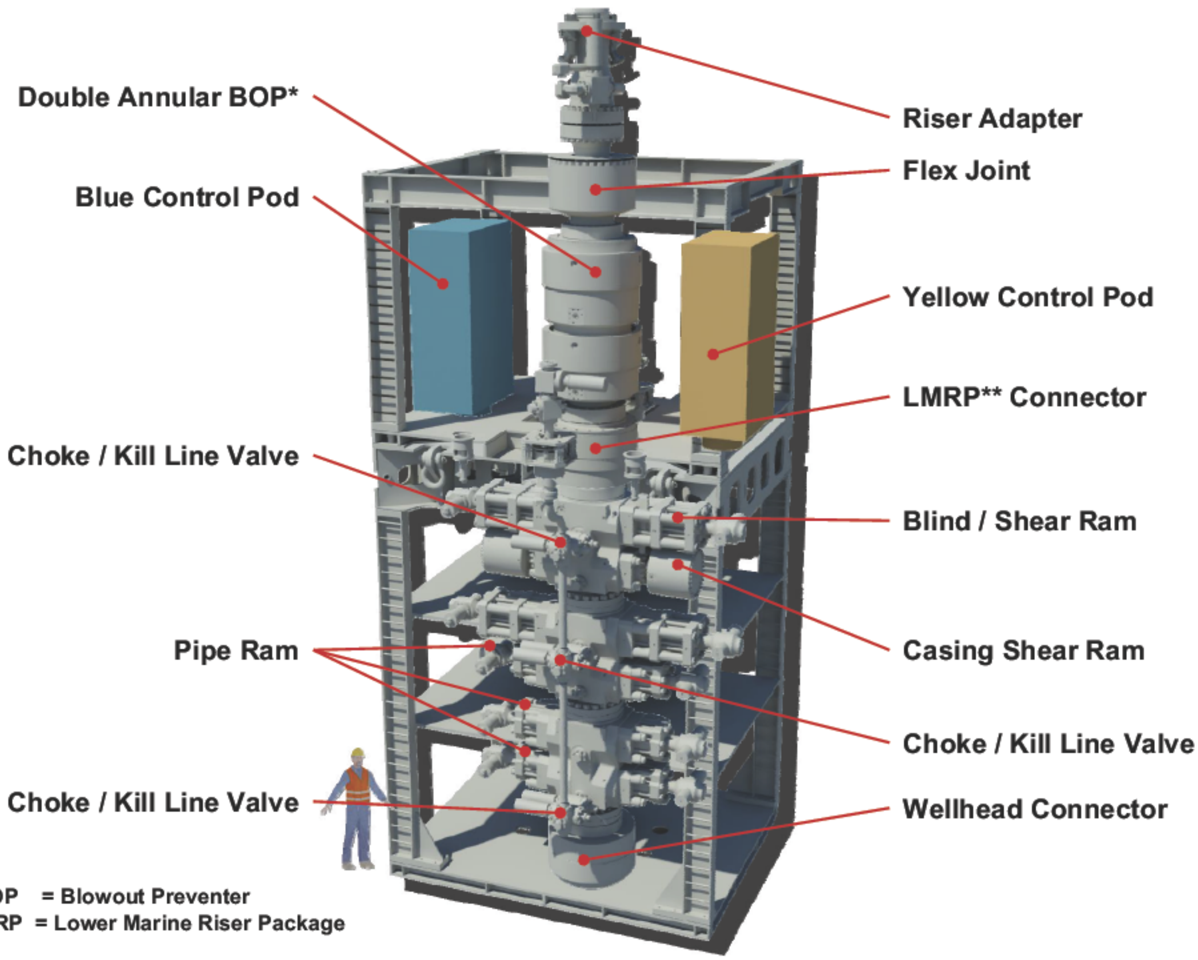
(202) 457-6594

(202) 351-1399 (cell)

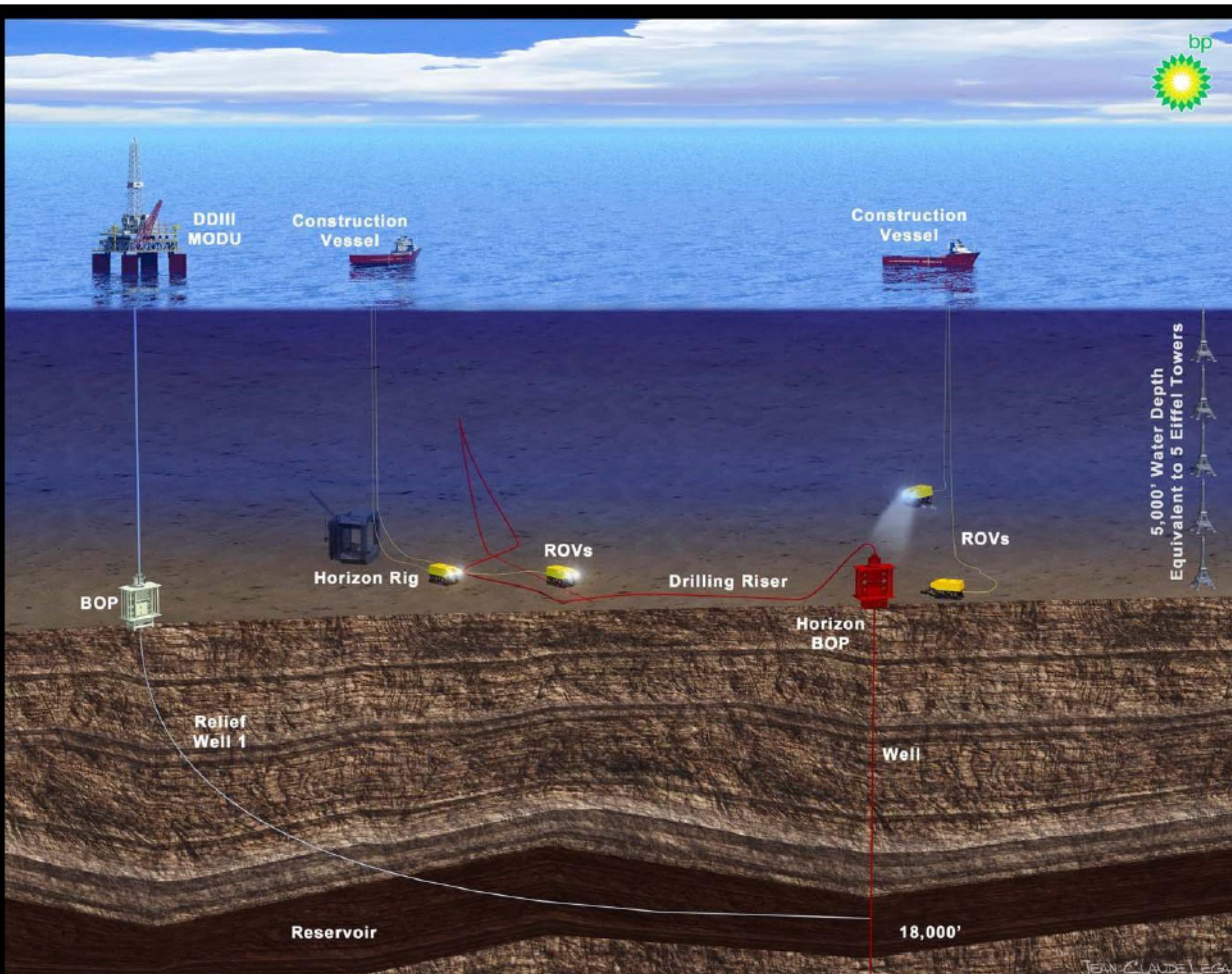
stjohnk@bp.com


Lower Marine
Riser Package (LMRP)
Blowout Preventer (BOP)

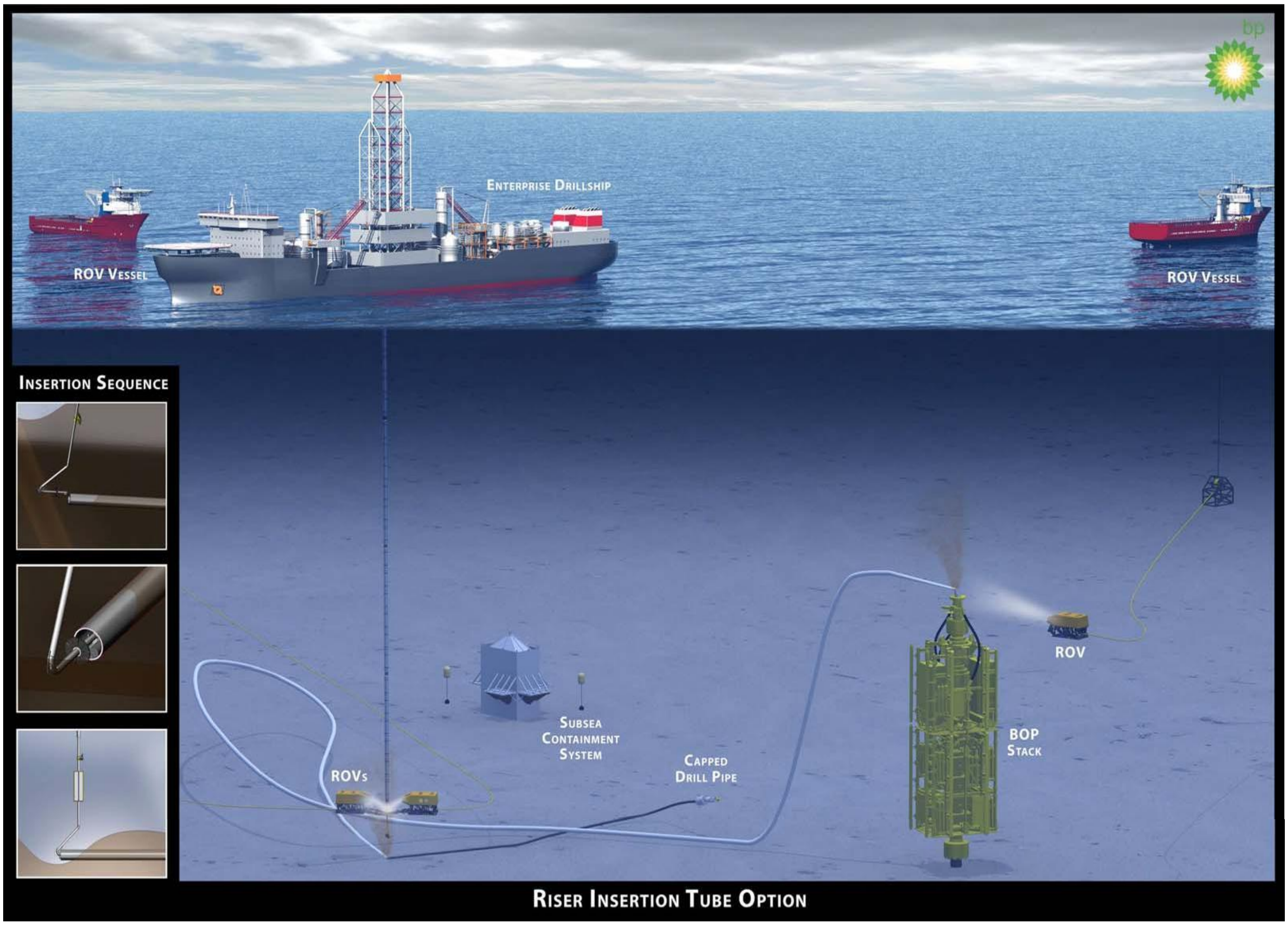
Example Subsea BOP Stack

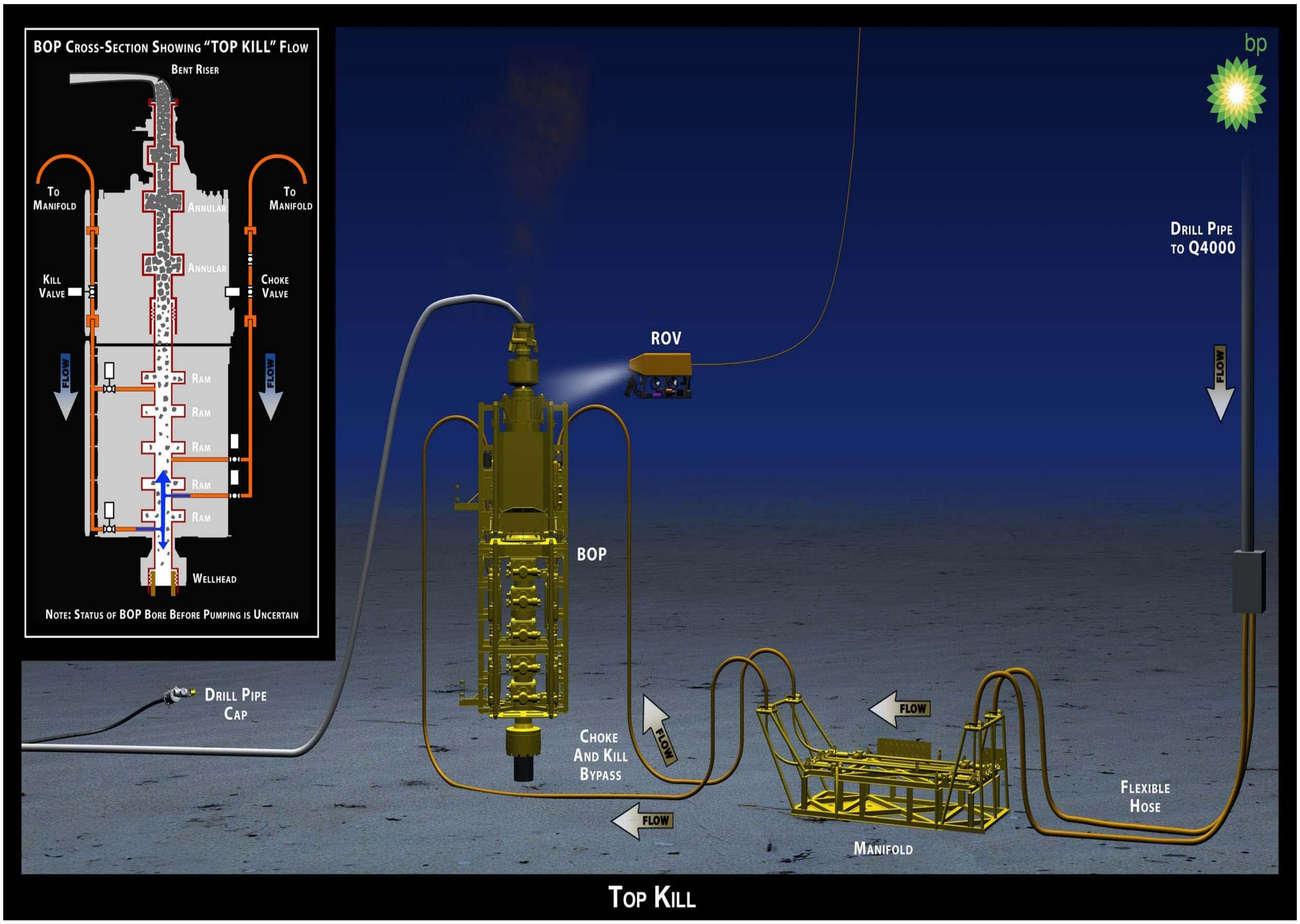


* BOP = Blowout Preventer
** LMRP = Lower Marine Riser Package

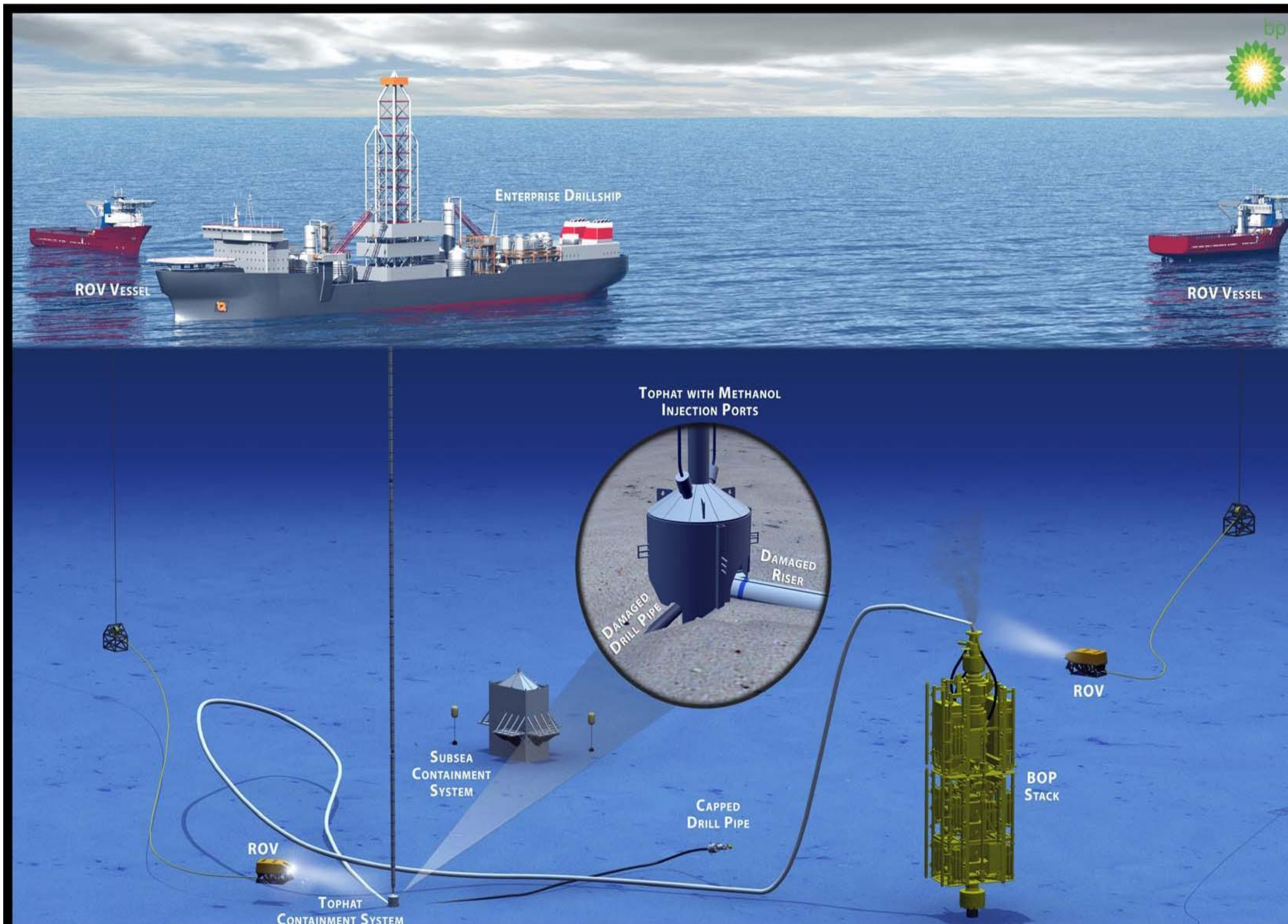


HORIZON RESPONSE CURRENT STATE

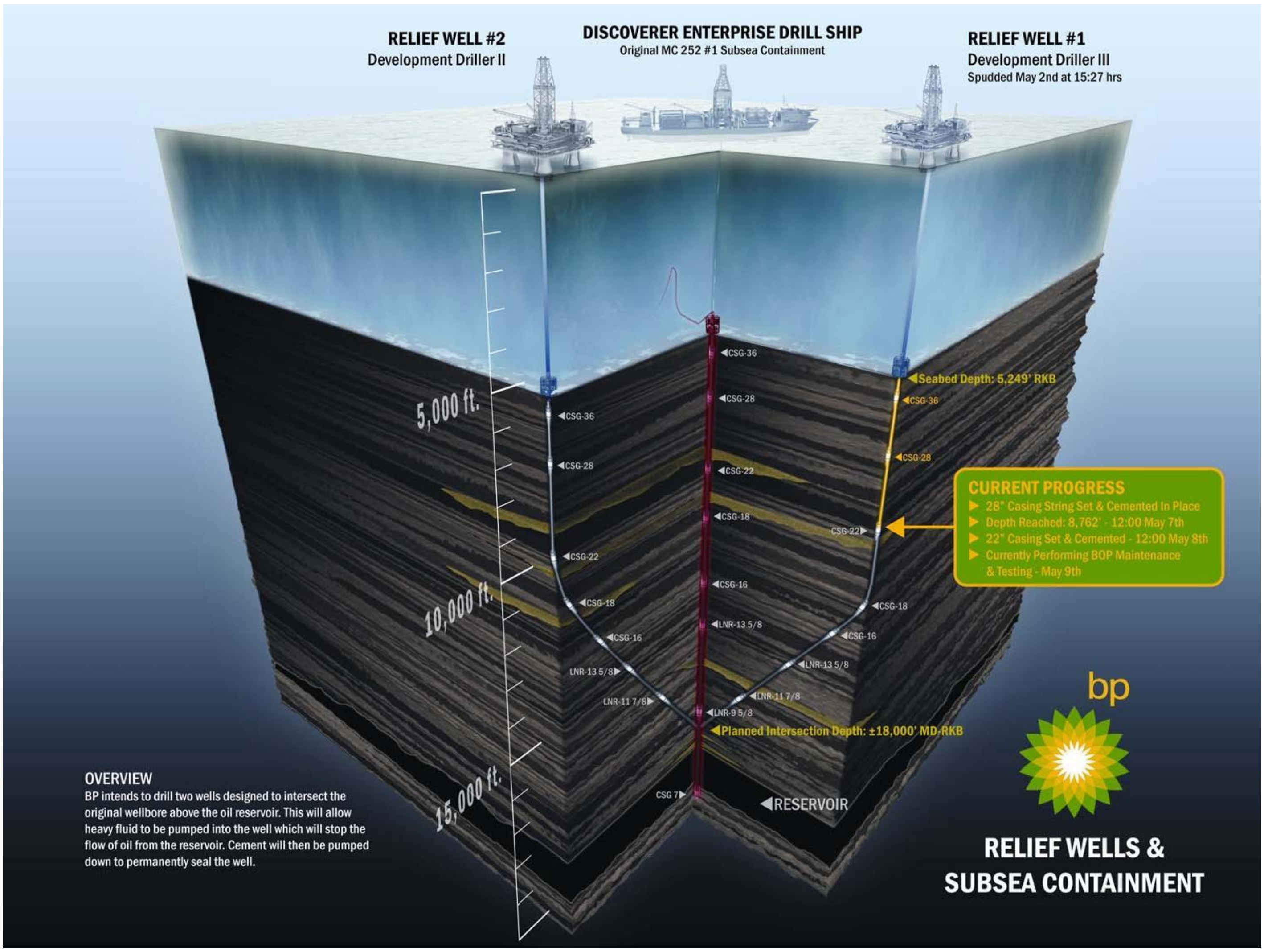

Enterprise Drillship
ROV Vessel
ROV Vessel
Insertion Sequence
ROV
Subsea
Containment
System
Capped
Drill Pipe
BOP
Stack
ROVs
Riser Insertion Tube Option

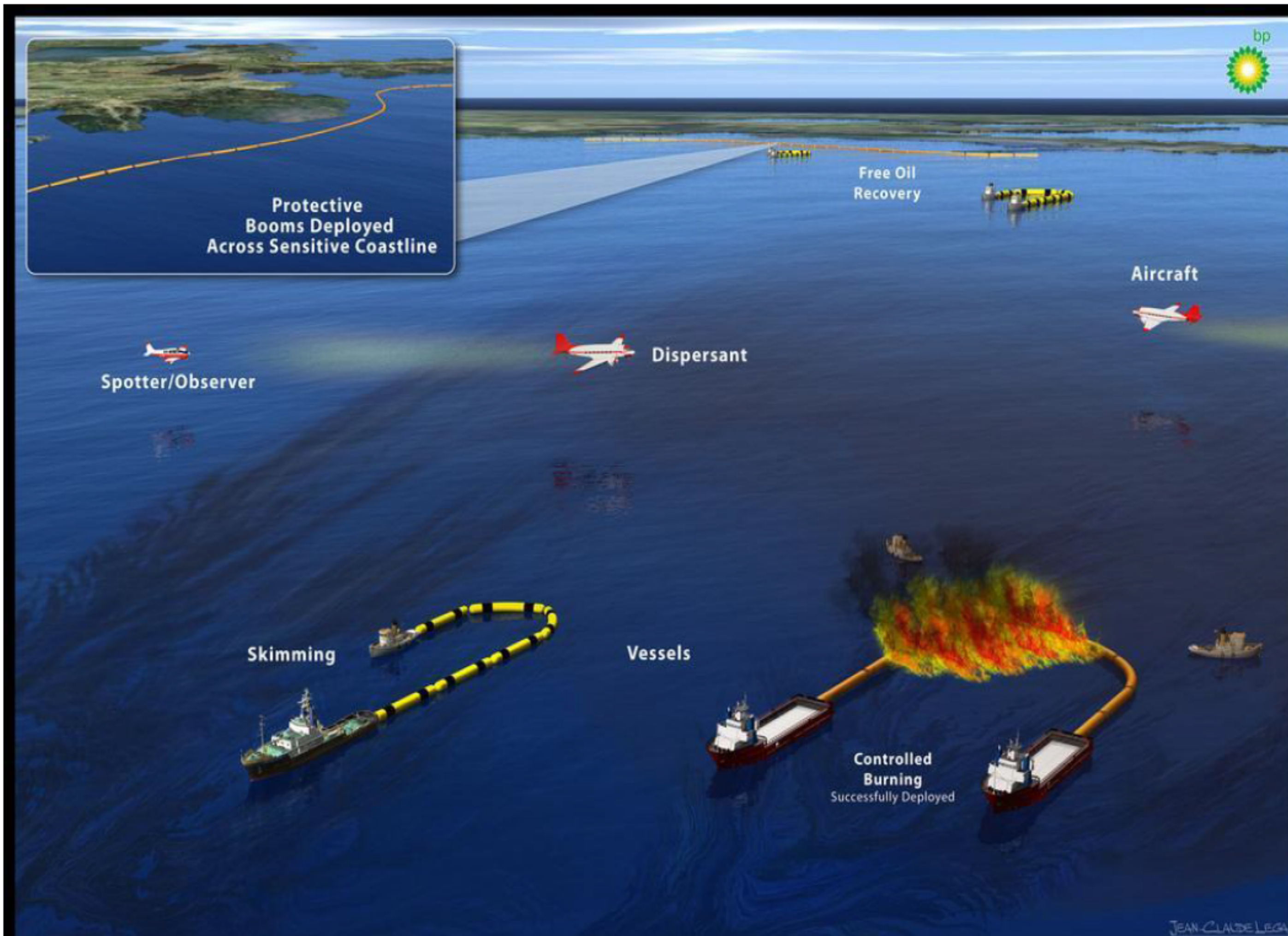


Document ID: 0.7.19.1946.1



Tophat Containment System Deployed


RELIEF WELL #2
Development Driller II
DISCOVERER ENTERPRISE DRILL SHIP
Original MC 252 #1 Subsea Containment
RELIEF WELL #1
Development Driller III
Spudded May 2nd at 15:27 hrs
5,000 ft.
10,000 ft.
15,000 ft.
CSG-36
CSG-28
CSG-22
CSG-18
CSG-16
LNR-13 5/8
LNR-11 7/8
LNR-9 5/8
CSG 7
Seabed Depth: 5,249' RKB
CURRENT PROGRESS
28" Casing String Set & Cemented In Place
Depth Reached: 8,762' - 12:00 May 7th
22" Casing Set & Cemented - 12:00 May 8th
Currently Performing BOP Maintenance & Testing - May 9th
Planned Intersection Depth: ±18,000' MD-RKB
RESERVOIR
OVERVIEW
BP intends to drill two wells designed to intersect the original wellbore above the oil reservoir. This will allow heavy fluid to be pumped into the well which will stop the flow of oil from the reservoir. Cement will then be pumped down to permanently seal the well.
bp
RELIEF WELLS & SUBSEA CONTAINMENT



Oil Spill Response Operation

Received(Date): Sat, 15 May 2010 07:07:02 -0400
From: Andrew Winer <Andrew.Winer@noaa.gov>
Subject: 2:30pm NGO Outreach Call
To: "dwh.staff@noaa.gov" <dwh.staff@noaa.gov>,"noaahq.leadership@noaa.gov" <NOAAHQ.Leadership@noaa.gov>
157758.doc

These are notes from the weekly 2:30 pm NGO status call sponsored by CEQ. Doug Helton represented NOAA and did a fantastic job.

Caren Madsen will be working on identifying a NOAA representative who can participate on this call. There were over 100 individuals on this call.

Andy Winer

Director of External Affairs

NOAA

(202) 482-4640

2:30 p.m. NGO call:

Speakers: Greg Nelson, WHO

Amy Salzman, CEQ

Doug Helton, Incident Operations Coordinator, Ocean Service Office of Response and Restoration, NOAA

Lisa Garcia, Senior Advisor to EPA Administrator on Environmental Justice

Q&A:

· Eleanor Huffines, Pew asked about receiving details on recovery estimates or the input parameters to compute estimates from Unified Command (see email below)

o **Follow-up needed from Coast Guard/DHS (see email below).**

· Bob Irvin, Defenders of Wildlife asked about the dredging situation in Mississippi and further information about the barrier island plan, including any plans for public comment and review by Fish and Wildlife Service

o Greg Nelson: Application has been submitted to Army Corps and is in the review process right now.

o **Need Follow-up re: public comment. Attached is a letter from Defenders' President Rodger Schlickeisen to the President regarding his supplemental budget request.**

· David Underhill, Mobile Sierra Club asked about the possibility of a supertanker/ large suction pump to remove the oil from the surface of the water. Are the dispersants making it more difficult? Are there pockets of oil underwater?

o NOAA: The oil at sea is very thin and they cannot use a vacuum.

· Chris Mann, Pew asked about an accurate estimate on the leak flow. Even though the video was just released, we now know that BP had the video for a while…

o NOAA: "Nothing would be different in our response."

· Monica Gardhert, Equity Inclusion Campaign asked about the legislative package, one stop assistance, case management, money from the state governments, and if there will be federal oversight.

o Greg answered. **Need Follow-up re: money from state governments?**

· Sarah Chasis, NRDC asked about studies re: impacts of the spill in the water column and on marine life. Is there an action plan that can be reviewed by the public?

o Greg answered: the process has started and the process will include public comment period.

o EPA: has enhanced monitoring of dispersants posted on website- FDA also monitoring health of consuming fish. NMFS also monitoring seafood safety

· John Lopez, Lake Pontchartrain Basin Foundation asked about the submerged plume of oil moving onto coast and how to prepare for response.

o **Need follow-up (Coast Guard/DHS/NOAA)**

· Sean Saville, National Audubon Society is working on the ground transport system; volunteered to help FWS, BP, and state agencies- Is there increased capacity to expand volunteer services to other coastal states (outside tri-state facilities). Mentioned challenges with putting volunteers to work. They have 20,000 volunteers on their website.

o **DOI (Ray Rivera) will follow up re: volunteer opportunities**

o **NOAA (Caren Madsen) agreed to receive emails re: training and volunteerism**

From: Susan Harvey [mailto:sharvey@mtaonline.net]
Sent: Thursday, May 13, 2010 11:40 AM
To: Harold Curran (NSB); Andy Mack (NSB); Eleanor Huffines; Marilyn Heiman; Peter Van Tuyn

Cc: Ben Greene (NSB); Tom Lohman (NSB)
Subject: GOM Spill Recovery Estimates
Importance: High

We are getting very little detail on recovery estimates or the input parameters to compute them from Unified Command.

I wanted to alert you to a few issues in case you have access to the right folks to improve the data reporting.

A few days ago I submitted a request to Unified Command via their suggestion web page asking them to provide more information on a few specific parameters, but I haven't seen any improvement yet.

I did listen to the UC Update yesterday; they reported the recovery volumes were being questioned and the USCG was being tasked with an oil spill recovery "budget" estimate Maybe improvements are coming? Hard to tell yet.

ISB:

The data on in-situ burning is extremely sparse. The Unified Command Operational Update Summary for each day's recovery and tools in place does not address ISB at all. There is no listing for the amount of ISB boom, ISB equipment, and ISB crews deployed. There is no information on the number of burns or removal rate.

The only way I can find out what has happened on ISB removal is to listen to the video press release updates, and every 3-4 days there is a brief mention.

Unified Command did post a ISB fact sheet a few days ago but it is unreadable. We have tried opening it on multiple computers with the same result.

http://www.deepwaterhorizonresponse.com/posted/2931/In_Situ_Burning_in_Oil_Spill_Response.536615.pdf

The last burn data shows 13,000 bbls removed which still puts removal efficiency at 10-11%. There is no data or information provided to support this estimate.

We really need more information on:

1. the number of burns,

2. locations of burns,

3. burn rate efficiency,

4. amount of accelerant used on burn (how much more pollution is added to start and sustain the burn), and

5. where burns have been successfully attempted and where they have been unable to sustain a burn.

This information is really critical to us for Arctic work. As you know industry currently estimates 90%+ burn removal. Actual field data from the GOM spill is showing 10-11% (if accurate) and the Macondo well oil at 35 API should burn much better than a number of our offshore crude oils that have lower API gravities (except Northstar that is higher).

Mechanical Recovery :

Unified Command is reporting the combined oily-water mix at 5 million gallons this morning, but they are not providing any data on the percentage of oil in the emulsion.

Getting an accurate amount of oil in the mixture is a simple matter of grabbing some emulsion samples and spinning them out in a centrifuge. We really need that number to estimate a more accurate oil recovery number. I have yet to see any reporting on that.

Eventually, they will run the oily water recovered mixture through and oil water separator to recover the oil and they can get a % oil number from that process. No data on that yet either.

For very rough calculations I have been assuming 40% oil content, but that is probably too conservative. It could be as low as 20%. This will swing the mechanical recovery estimate from 20-40%. So it would be very useful to get better data on this.

Unified Command is also showing that they are essentially picking up 5000 barrels of oily water each day (keeping up with the spill rate). This seems very high, and there isn't enough detail to support this pickup rate. Hopefully this new USCG oil recovery "budget" they are working on will provide better detail.

Total Spill Rate:

Of course the denominator in all the recovery calculations is based on a 5000 bopd leak rate assumption. If that is incorrect then that will also reduce all the recovery numbers. I did read that scientists are examining this number more carefully, so hopefully we will be getting better data on this.

For every 1000 bopd increase in oil spill volume the mechanical recovery rates drop by 3-7%. And the ISB removal drops by 2% for every 1000 bopd increase in oil spill volume.

For example if the oil spill rate is actually 8,000 bopd (not 5,000 bopd) then mechanical recovery drops to 12-25% and ISB removal to 7%.

Susan Harvey

Harvey Consulting, LLC

PO Box 771026

Eagle River, Alaska 99577

(907) 694-7994 Phone

(907) 694-7995 Fax

(907) 854-8998 Cell

sharvey@mtaonline.net

AT&T TeleConference Services
Special Services Center
800 932-1100 E-mail: teleconference@att.com
Conference Participant List

To:	SHASTI CONRAD
E-mail Address:	sconrad@who.eop.gov
Conference ID #:	157758
Company Name:	EOP
Host's Name:	TINA TCHEN
Name of Conference:	GULF UPDATE CALL
Date of Conference:	FRIDAY, MAY 14, 2010 2:30PM EASTERN

	NAME	ORGANIZATION
1.	**GARCIA, LISA - SPEAKER**	
2.	**HELTON, DOUG - SPEAKER**	
3.	**MADSEN, CAREN - SPEAKER**	
4.	**RIVERA, RAY - SPEAKER**	
5.	ALBERSWERTH, DAVID	THE WILDERNESS SOCIE
6.	BANTA, DREW	STATE OF LOUISIANA GOVERNORS OFFICE
7.	BARNES, ROBIN	SEEDCO FINANCIAL
8.	BENOIT, JEFF	RESTORE AMERICAS ESTUARIES
9.	BUCHANAN, JEFFREY	OXFAN AMERICA
10.	BURBANK, PENNY	THE STEPS COALITION
11.	BUTLER, LIZ	1SKY
12.	CHASIS, SARAH	NIDC
13.	COMER, PATRICK	NATURESERVE
14.	COSGROVE, SEAN	CONSERVATION LAW FOU
15.	CRIST, PATRICK	NATURESERVE
16.	DECOCK, JOHN	CLEAN WATER ACTION
17.	DEWEY, ROBERT	DEFENDERS OF WILDLIFE
18.	ESTOLANO, CECILIA	GREEN FOR ALL
19.	GAGE, KATE	ETA
20.	GARHART, MONIKA	THE EQUITY & INCLUSION CAMPAIGN
21.	GRAVITZ, MIKE	ENVIRONMENT AMERICA
22.	HUFINEF, ELEANOR	PUPEW
23.	KEMP, PAUL	NATIONAL AUDOBON SOCIETY
24.	KIERNAN, TOM	NPCA
25.	KLEIN, MARY	NATURESERV
26.	KNADLE, GREG	NATIONAL FISH & WILDLIFE
27.	LOPEZ, JOHN	LAKE PONCHITRAIN FOUNDATION

In order to expedite the assembly of your call, some names may have been spelled phonetically.

Please feel free to contact us at 1-800-932-1100 if you have any questions or if we can be of further assistance.
Thank you for using AT&T Executive TeleConference Service.

Conference Participant List

28.	LOWELL, BETH	OCEANA
29.	LYON, JIM	NATIONAL WILDLIFE FEDERATION
30.	MANN, CHRISTOPHER	PEW ENVIRONMENT GROUP
31.	MATHIAS, JAIME	NATIONAL WILDLIFE FEDERATION
32.	MONJE, CARLOS	WHITE HOUSE DOMESTIC POLICY COUNCIL
33.	NAZAR, HASAN	THE LEAGUE OF CONSERVATION VOTERS
34.	OLSON, JODIE	NATIONAL FISH & WILDLIFE
35.	OWENS, STEPHANIE	DEPA
36.	PARSONS-DRAKE, DEBRA	THE HUMANE SOCIETY OF US
37.	PHAM, DAVID	BPSOF
38.	PRIOR, MELISSA	PEW ENVIRONMENT GROUP
39.	PUSKAR, DAN	NATIONAL PARK FOUNDATION
40.	RIVERA, ROGER	ENVIRONMENTAL COUNCIL
41.	SALZMAN, AMELIA - HOST	202 456-7436
42.	SAVILLE, SEAN	NATIONAL AUDOBON SOCIEY
43.	SAVITZ, JACKIE	OCEANA
44.	SCHILBWACHTER, GREG	WATERSHED RESULTS
45.	SPRUILL, VIKKI	OCEAN CONSERVANCY
46.	ST.MARTIN, MARCIA	SEWERADE WATER OF NEW ORLEANS
47.	TINNING, MATTHEW	NATURE CONSERVANCY
48.	UNDERHILL, DAVID	MOBILE BASED SIERRA CLUB
49.	VENKER, TED	COASTAL CONSERVATION ASSOCIATION
50.	WINER, ANDY	NOAA

In order to expedite the assembly of your call, some names may have been spelled phonetically.

Please feel free to contact us at 1-800-932-1100 if you have any questions or if we can be of further assistance.
Thank you for using AT&T Executive TeleConference Service.

Received(Date): Sat, 15 May 2010 09:48:25 -0400
From: Beth Dieveney <Beth.Dieveney@noaa.gov>
Subject: May 15 NOAA Deepwater Horizon Call Actions
To: Deepwater <Deepwater.HorizonDist@noaa.gov>
BISCO_Town Hall Meeting_5-13-10.docx
Port Sulfer Community Meeting on 5-13-10.doc
NGO Call 5-14-10.doc
NIC DC Org Chart12May.xlsx

NOAA Daily DeepWater Horizon Call
Saturday, May 15, 2010
[redacted]

Call Guidelines:

- Place your phone on mute at all times unless you are speaking
- **Do not** place your phone on hold

Other Attachments

report from BISCO community meeting (5/13)
report from Port Sulfer community meeting (5/13)
report from weekly NGO call (5/14)
NIC structure diagram

Action Items

- ADML Landry request 30-day ship time, use of the Gordon Gunther for dispersant modeling, paperwork is being processed. Assess what asset is needed as the Gordon Gunther is currently being used for larvae sampling and impacts of oil on larvae (particularly blue-fin).
  - Identify what other NOAA/academic assets has that are comparable and go through (Kenul)
  - Connect with Unified Area Command to determine needs and how needs could be met by other NOAA /academic assets (Westerholm)
- Overview of sampling that is not being done, broad issues related to understanding where the oil is and what its impact is (all assets, not exclusive to NOAA assets) Requested to send this to the NIC (Murawski and team)
- Report on marine mammals and turtles – be clearer regarding how many are deceased due to oil and what is not known; share a total each day (ORR/ICC reports)
  - NOAA requested to create daily chart showing mortality in relation to: #of total dead turtles, # sent for necropsies, # necropsies completed, and # dead due to oil.
  - DOI asked to do the same for birds
- Assess capacity to conduct work needed – request to review this and if more people are needed (marine mammal stranding, necropsy processing, seafood safety testing, etc)
- NMFS to develop timeline of seafood safety testing in advance of Monday Meeting/call at WH.
- Ensure routine updates on 0800 calls on key issues NOAA is working on
- Ensure clear lines of communication and updates between NOAA and NIC, etc. (Dieveney/Westerholm)
- Follow-up call regarding engaging NOAA more effectively in NIC process (Lubchenco,

Spring, Sarri)

- Reconstruct process of how NOAA has been engaged with developing/communicating release rate (ORR Seattle)
- Contact sheet for where to refer constituents to for key information (Dieveney/Winer)
- Strategies to communicate our issues, particularly NMFS closures to public (Sutter/Winer)
- Assign lead technical expert for LA barrier island issue (Yozell)
- Check in on monitoring plan regarding use of sub-sea dispersants (Westerholm/Henry)
- Develop product for what our NERR and NM Sanctuary sites are seeing (NOS)
- Follow-up on release of chemical contents of dispersants for seafood safety testing needs (Kennedy/Westerholm)

Updates of Interest

- Information on the Loop current to the NIC through the Environmental Assessment Work-Group – need to push back on this, NOAA needs a higher level presence of this
- ACOE and fill-in on barrier islands – will be referred to legal committee on NRT to ensure all Federal agency issues are considered; going to legal due to the question of if this is really a response issue

Documents cleared through WH clearance process for 5/11/10
(currently, this list is incomplete but will be updated on a daily basis)

FACT SHEETS – CLEARED & POSTED ONLINE

- Booms
- Coral reefs & oil
- Marine mammals and sea turtles
- Gulf of Mexico Oil Spill General (Fish)
- Fish stocks in the Gulf of Mexico
- Seafood safety
- Impact of crude oil on seafood
- Natural Resources Damage Assessment
- Shorelines and coastal habitats in the Gulf of Mexico
- Dispersants (OR&R sheet)
- Shoreline & habitats (OR&R sheet)
- Shoreline Cleanup and Assessment Technique (SCAT) (OR&R sheet)

FACT SHEETS – IN CLEARANCE/WORK

- Sheen (cleared/not posted)
- Oil weathering/types
- Loop current
- Mussel Watch
- NOS activities
- Hypoxia (dead zone) & oil

Websites for more information:
OR&R Response Outreach – http://response.restoration.noaa.gov/deepwaterhorizon (cleared fact sheets)
Deepwater Horizon JIC – www.deepwaterhorizonresponse.com (cleared factsheets)
ResponseLink – https://responselink.orr.noaa.gov
NOAA ICC Sitreps - https://www.homelandsecurity.noaa.gov/icc_sitreps.html
Updates on Fisheries Closure – http://sero.nmfs.noaa.gov/
Daily updates to NOAA nautical charts: http://www.nauticalcharts.noaa.gov/.

Joint Information Center Contacts (as of 5/11/10)
David Miller / 202-329-4030 (LA) david.p.miller@noaa.gov (through Monday, May 17th)
Connie Barclay / 202-441-2398.
Replacement: Rachel Wilhelm arrives Sat., May 15th / 202-657-9816.

NOAA Scientific Scientist Coordination on site (as of 5/7/10)
Charlie Henry (206-849-9928) - Robert
Steve Lehman (617-877-2806) - Robert
Jordan Stout (206-321-3320) - Houma
John Tarpley (206-526-6338) - Houma
Mary Gill (206-849-9953) - Mobile
Ruth Yender (206-89-9926) - Mobile
Brad Benggio (206-849-9923) - St. Pete

Carl Jochums – NOAA contractor boom expert on site.

Beth Dieveney
NOAA Program Coordination Office
Office of the Under Secretary
14th & Constitution Ave., NW, Room 5811
Washington, DC 20230

phone: 202 482 1281
cell: 240 328 4812
fax: 202 482 4116

HOUMA, LA – COMMUNITY MEETING, BISCO, TERREBONNE PARISH – MAY, 13, 2010 – DULOUC, LA

Principal Attendee: David Kennedy

Representatives from various Federal and State agencies, BP representative, as well as Local leaders.
Attendees: approximately 100 – 125 people

FEDERAL/STATE/LOCAL REPS:
NOAA
USCG
SCAT Team lead
EPA, senior advisor to Lisa Jackson
EPA – Assistant Secretary of Solid Waste / Emergency Response
ATSDR / CDC - toxicologist
DOI
BP Representative
Terrebonne Parrish President

GENERAL SENTIMENT:

- Fear
- Worry
- Uncertainty
- Anger
- Lack clear understanding of the situation / potential impacts

WHAT THE COMMUNITY WOULD LIKE:

- PROCESS / CLAIMS: want BP rep in the community to be on hand for processing of claims, general explanations and updates. People feel they were not being communicated with.
- ECONOMIC IMPACT: Community fears BP will fulfill fiduciary responsibilities
- HEALTH IMPACT: Information on what the short and long term health effects are going to be.
- EDUCATION / INFORMATION: Want information not just posted on the web – not everyone has access to the internet.
- EMPLOYMENT OPPORTUNITIES: Vessels of Opportunity. Not enough boom available to utilize private vessels

WHAT NOAA CAN PROVIDE:

- INFORMATION
    - Factsheets
        - Printed and delivered to the community as well as online.
        - Information for students / educators
    - Trajectories
    - Updates / Centrally located, up to date

  - Safety
    - Seafood
    - Operational – Vessels / Human use
    - Wildlife
  - Dispersants – provide information >what is it? What is it used for? What are the long term effects?
- PRESENCE
  - Would like to have people on the ground / need to know what is going on, when can they fish, for how long, want people to get information from, not have to use the telephone / internet.
- LONG TERM PLAN – WANT A LONG TERM PLAN

<u>QUESTIONS / ANSWERS</u>

1. When oil is displaced, it has been proved by two colleges to cause cancer – what effect is this going to have on the environment in the future years. As dispersant is being used, require monitoring for impacts. Tar can be irritating – dispersant / application no concern to people on shore
2. As a community don't need feel good speeches – want an outlined, long term plan of what BP is going to do – (applause) – sickness? partial payment – not enough info.
3. Want a long term plan, want to know what's going to happen to the community.
4. vessels of opportunities – employment – $1,000 / day for use of boats > have claims available > get up to $5,000 – not limited to one claim. – BP – we want to do right by this community. – Fed agencies will assure this will never happen again. Community – some people don't have two weeks. Need immediate assistance.
5. Do you know where the dispersant are in the deep water?
6. Are they going to be moving inland with the tides?
7. Need to know what's underwater where is the dispersant?
8. Need to know how our fisherman are going to know, if they are being exposed to dispersants.
9. Need to know what the health effects are – dermal contact, what they are inhaling?
10. Want test results posted publicly.
11. BP needs to focus on shutting the faucet off. more of a statement / request than question.
12. Feds – needs to be taking care of the people.
13. What is the name of the dispersant?
14. Is there an expiration date for the dispersant?
15. Can you guarantee us you are going to pay us?
16. We've heard you can file a $5,000 claim – once you sign it, you can't get more money. Is this true? BP, has been asked to set up a claim center – should be accommodated – BP rep looking into it
17. What is the dispersant called? Corexit – results of testing – EPA – are the results available?

18. State Legislation being held up? – BP holding up in baton rouge state legislature – BP will only pay 72%
19. Oysters – does bp or epa have a way of testing to see if there is any mercury – DNA test or some other type of testing? – DK noted– food safety report coming out
20. Our nation benefits in and from our communities – but we bear the brunt of it through land loss issues, seafood industry, what can we as a community do and what can we expect to be done – economically, socially, and environmentally to mitigate?????
21. Getting mixed information – how do you inform teachers and students about the oil spill?

Port Sulfer Community Meeting on 5-13-10

Principal Attendee: Mary Glackin

GENERAL SENTIMENT::

* Fear of the unknown
* Frustration
* Anxiety

Anger and distrust primarily aimed at BP but included the Federal Agencies, i.e., EPA, USCG, and OSHA. I have to state while in the Port Sulphur and Boothville-Venice community, NOAA was clearly appreciated and we were personally thanked and welcomed by individuals for the effort and products, e.g., the Situation Status Map and folks on the ground.

The fear and anxiety was focused on (1) The long-term health effects of the dispersants, both to marine life and the community. Local commercial fishermen were comparing the EXXON VALDEZ incident with the current situation citing Alaskan sources claiming the permanent loss of the herring runs due to the use of dispersants (citing a neurotoxin threat) during the VALDEZ cleanup; (2) The President of the Plaquemines Parish Oystermen's Association compared the use of dispersants and the potential of unknown long-term effects to the use of Agent Orange in Vietnam, which the US government assured was not toxic. This is a critical community issue that needs to be addressed; (3) The air quality was repeatedly voiced as a major concern to children and those individuals affected with asthma and other related respiratory ailments. Air quality was a major issue with the Louisiana Bucket Brigade a 501(c)(3) environmental health and justice organization working with communities that neighbor the state's oil refineries and chemical plants.(http://www.labucketbrigade.org/); EPA needs to articulate a consistent message and define the "standards" used for air quality to allay the communities anxiety.

WHAT THE COMMUNITY WOULD LIKE:

Issues are related to BP claims and programs to put fishermen to work. (1) The BP process is not working and immediate compensation is needed for the commercial fishermen. The system of classification re who can file a claim does not guarantee those applying are truly commercial, i.e., suggestions of improprieties- commercial vice recreational making claims. The $5K limit on expedited compensation claims is not enough to pay monthly bills during the peak of their season. The "Vessels of Opportunity" BP program is not working. It was intimated the preference locally, is to hire out charter boats (used by recreational fishermen) for BP hosted activities rather than the artisanal vessels; (3) the community attorneys are asking for graduated compensation claims for workers based on their roles, e.g., vessel owner, deckhands, processors etc for a period of at least 6 months.

SOCIO-ECONOMIC AND CULTURAL IMPACT

There was great concern expressed over the loss of the cultural heritage associated with artisanal fishing and literally, cultural genocide- the generational impact on the ability to make a living on the water and the contamination of marine life for generations to come.

EDUCATION AND INFORMATION:

The Internet and URL addresses are not enough. More printed material and handouts would be of great use to the affected communities.

Attached is a copy of the NOAA Extreme Weather Information Sheet (NEWIS) for an example template that could be modified to identify activities, POCs, and the appropriate agencies associated with response related to the DW HORIZON spill event.

WHAT CAN NOAA/FEDS PROVIDE:

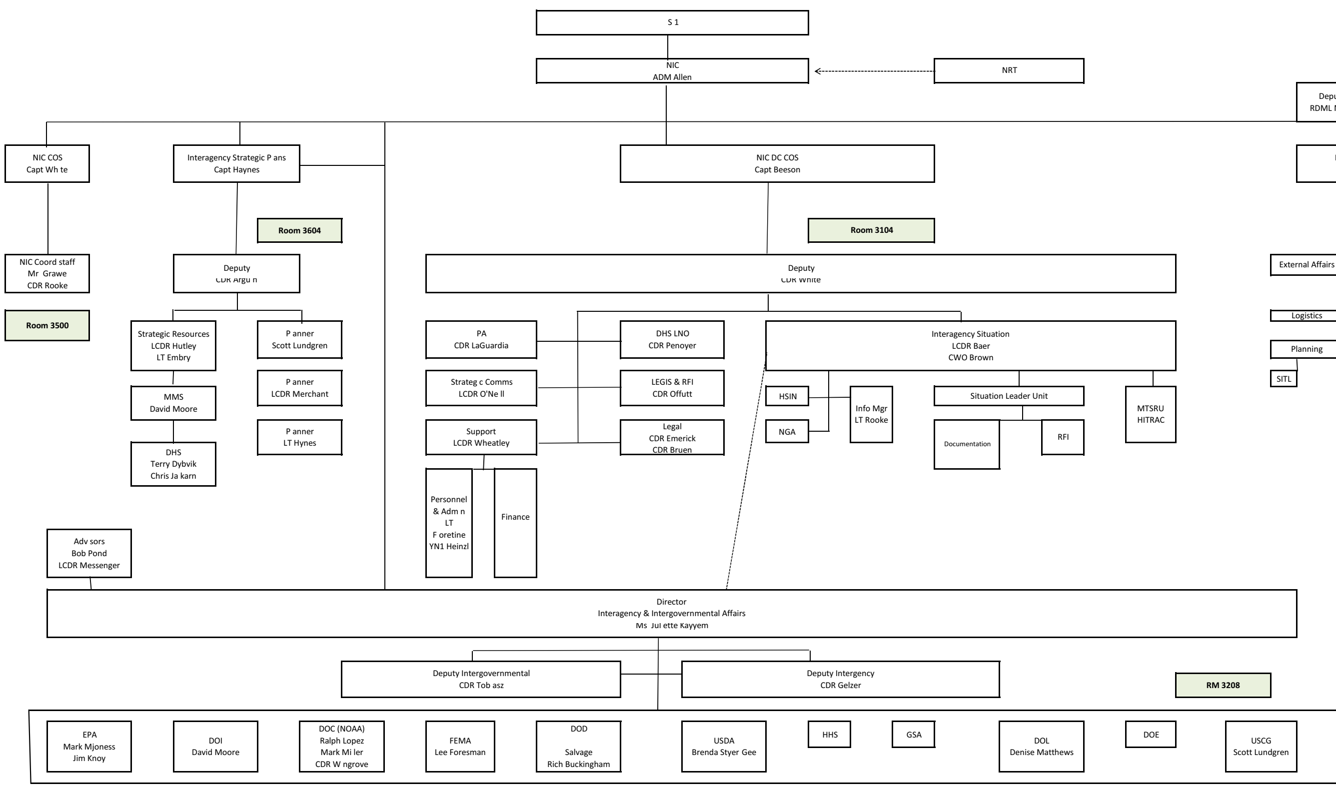
How can NOAA verify BP environmental reports? What can NOAA do get an accurate measurement of the flow rate of the leaks. Community participants cited news articles from the academic community indicating the flow rate may be 5 times greater than reported causing distrust of the BP and federal numbers. Participants also cited EPA data indicating elevated levels of hydrogen sulfide. Can NOAA give an estimate on the total number of gallons at the bottom of the Gulf, and water column estimates? How many miles offshore is the extent of the spill? How many miles of the coastline have been affected? And, lastly consistent, understandable communications to the public coordinated through the federal activities involved.

Friday, May 14 – 2:30 p.m. NGO call:

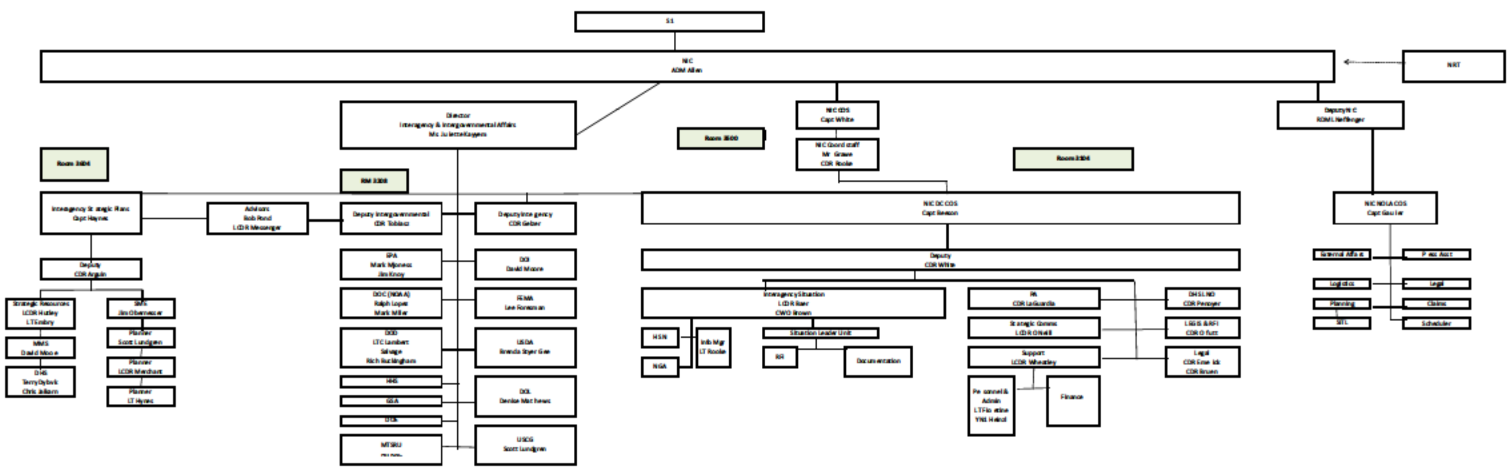
Speakers: Greg Nelson, WHO
Amy Salzman, CEQ
Doug Helton, Incident Operations Coordinator, Ocean Service Office of Response and Restoration, NOAA
Lisa Garcia, Senior Advisor to EPA Administrator on Environmental Justice

Q&A:

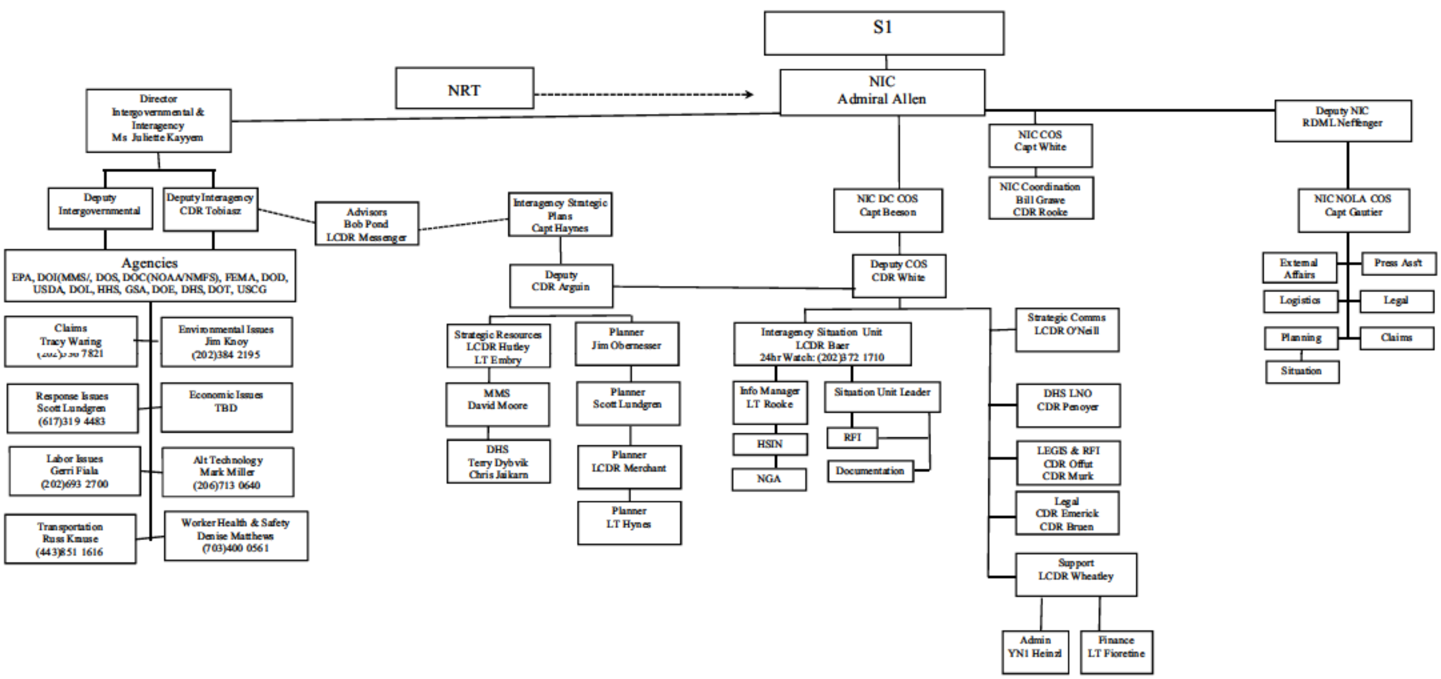
- Eleanor Huffines, Pew asked about receiving details on recovery estimates or the input parameters to compute estimates from Unified Command (see email below)
    - **Follow-up needed from Coast Guard/DHS (see email below).**
- Bob Irvin, Defenders of Wildlife asked about the dredging situation in Mississippi and further information about the barrier island plan, including any plans for public comment and review by Fish and Wildlife Service
    - Greg Nelson: Application has been submitted to Army Corps and is in the review process right now.
    - **Need Follow-up re: public comment. Attached is a letter from Defenders' President Rodger Schlickeisen to the President regarding his supplemental budget request.**
- David Underhill, Mobile Sierra Club asked about the possibility of a supertanker/ large suction pump to remove the oil from the surface of the water. Are the dispersants making it more difficult? Are there pockets of oil underwater?
    - NOAA: The oil at sea is very thin and they cannot use a vacuum.
- Chris Mann, Pew asked about an accurate estimate on the leak flow. Even though the video was just released, we now know that BP had the video for a while…
    - NOAA: "Nothing would be different in our response."
- Monica Gardhert, Equity Inclusion Campaign asked about the legislative package, one stop assistance, case management, money from the state governments, and if there will be federal oversight.
    - Greg answered. **Need Follow-up re: money from state governments?**
- Sarah Chasis, NRDC asked about studies re: impacts of the spill in the water column and on marine life. Is there an action plan that can be reviewed by the public?
    - Greg answered: the process has started and the process will include public comment period.
    - EPA: has enhanced monitoring of dispersants posted on website- FDA also monitoring health of consuming fish. NMFS also monitoring seafood safety
- John Lopez, Lake Pontchartrain Basin Foundation asked about the submerged plume of oil moving onto coast and how to prepare for response.
    - **Need follow-up (Coast Guard/DHS/NOAA)**
- Sean Saville, National Audubon Society is working on the ground transport system; volunteered to help FWS, BP, and state agencies- Is there increased capacity to expand volunteer services to other coastal states (outside tri-state facilities). Mentioned challenges with putting volunteers to work. They have 20,000 volunteers on their website.
    - **DOI (Ray Rivera) will follow up re: volunteer opportunities**
    - **NOAA (Caren Madsen) agreed to receive emails re: training and volunteerism**



Document ID: 0.7.19.1920.4



Document ID: 0.7.19.1920.4



Document ID: 0.7.19.1920.4

Received(Date): Sat, 15 May 2010 10:46:45 -0400
From: Linda.Belton@noaa.gov
Subject: Fwd: 9:05 a.m. Pre-Brief Call on Sunday
To: dwh.staff@noaa.gov, Monica.Medina@noaa.gov, John.Gray@noaa.gov,Margaret.Spring@noaa.gov
Cc: John.Oliver@noaa.gov, Jen.Pizza@noaa.gov, Michael.Jarvis@noaa.gov,Jessica.Kondel@noaa.gov
Attachment

Received(Date): Sat, 15 May 2010 10:41:29 -0400
From: "McGrath, Shaun L." <Shaun_L._McGrath@who.eop.gov>
Subject: 9:05 a.m. Pre-Brief Call on Sunday
To: "McGrath, Shaun L." <Shaun_L._McGrath@who.eop.gov>,"Belton, Linda" <Linda.Belton@noaa.gov>,Monica Medina <Monica.Medina@noaa.gov>, heather.smith1@dhs.gov,"Tennyson, Stephanie L" <Stephanie.Tennyson@dhs.gov>,Pallone.Sarah@epamail.epa.gov, Lori_Faeth <Lori_Faeth@ios.doi.gov>,"Kayyem, Juliette" <Juliette.Kayyem@dhs.gov>,"Murk, David CDR" <David.W.Murk@uscg.dhs.gov>

All,

Daft agenda for the call tomorrow is below. Please let me know if there are any changes.

Sunday, May 16 Call with Governors

9:05 a.m. pre-brief; 9:15 Governors

[redacted] b6

[redacted] b6 **– Speakers**

[Guest Pin: [redacted] b6

Please limit participation in the pre-conference to speakers and essential staff.

<u>DRAFT AGENDA</u>

· Opening remarks (Valerie Jarrett)

· Observations and Trajectory – **Monica Medina, NOAA**

o NOAA will provide the latest observations and trajectories

· Situation and Leak Stabilization Update – **Adm Landry**

o Latest information from National Incident Command, including current status of efforts to stabilize the leaks.

· Operations Report –**Adm Landry, UAC**

o Response Plans and Boom

o Landry – riser insertion tube is the big event for today. Jindal asked about its effectiveness. Answer is 100% for the large leak. (the small leak will be treated by dispersant). Action item: report on success of insertion.Subsea dispersant – EPA reported that dispersant had been authorized for application with strict protocols. Landry reported that they will begin application today. Action item: report out on the success of the application. Ongoing testing of the dilution effect and the environmental impact.

o Landry – gave cleanup report: crews working on Port Fouchon; Whiskey Island; had trouble getting to Chaneleur. 90 vessels in MS; 64 in AL. Boom positioned; 75,000 feet in LA yesterday to close the gap in need.

o Riley asked about the cleanup and the importance of being sensitive to the public – need to show we are open for business. He suggested that the cleanup crew take off the HazMat suits on the beaches. Landry said will try to get the crews out earlier before the tourists start arriving.

o Riley urged more boom in Marlin County (sp?)

o Jindal urged more boom Westward – Terrebonne; St. Mary's; Labouche (sp?)

· Wildlife Impacts – **Eileen Sobeck, FWS**

· Fisheries Closures **– Monica Medina, NOAA**

o Monica said NOAA is working on a seafood safety statement that they will share with the Governors. They hope to release it soon.

· Open discussion and Q&A with Governors and state officials

· Next call – 9:15 a.m. EDT (8:15 CDT) Monday, May 17, 2010

·

Received(Date): Sat, 15 May 2010 10:55:05 -0400
From: Linda.Belton@noaa.gov
Subject: Notes from Governor's Call Saturday May 15
To: dwh.staff@noaa.gov, Monica.Medina@noaa.gov, John.Gray@noaa.gov,Margaret.Spring@noaa.gov, Sally.Yozell@noaa.gov
Cc: John.Oliver@noaa.gov, Jen.Pizza@noaa.gov, Jacqueline.J.Rousseau@noaa.gov,Michael.Jarvis@noaa.gov, Jessica.Kondel@noaa.gov
Dredging process TPs.docx

Notes from Governor's Call: Saturday May 15

Moderator: Cecelia Munoz- WH Intergovernmental Affairs

Governors: Riley, Jindal

- Admiral Landry – riser insertion tube is the big event for today. Governor Jindal asked about its effectiveness. Answer is 100% for the large leak. (the small leak will be treated by dispersant). Action item: report on success of insertion.
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- Gov. Riley asked about the cleanup and the importance of being sensitive to the public – need to show we are open for business. Responding to a photo he saw in this mornings New York Times, he suggested that the cleanup crew take off the HazMat suits on the beaches. Adm. Landry said will try to get the crews out earlier before the tourists start arriving.
- Gov. Riley urged more boom in Baldwin County.
- Gov. Jindal urged more boom Westward – Terrebonne; St. Mary's; Labouche (sp?)
- Monica Medina said NOAA is working on a seafood safety

statement that they will share with the Governors.

Additional Items:

- Attached are draft talking points and the process description of the dredging approval process that was developed by the USA COE and the NIC.
- Language Translation of documents: White House Office of Asian Affairs and the State Department (with BP) are providing translation services of documents (press releases, Q&A, etc.) into Vietnamese and other languages. Please contact Miya Chen (miya.chen@ed.gov) or Audrey Buehring at 202-453-5506 (audrey.buehring@ed.gov). They will facilitate the process with State Department translators.

Please see below the TPs and Process developed by USACE and the NIC Interagency Group regarding the dredging proposal in Louisiana.

High level talking points:

- The dredging proposal submitted to the USACE by the State of LA is currently undergoing expedited review for engineering and environmental feasibility in coordination with NOAA, EPA, DOI, USDA and other affected federal, state, local and tribal entities.
- Once the proposal review is complete, the Federal On-Scene Coordinator, with advice from the National Incident Commander and input from BP as the responsible party, will assess the proposal's effectiveness in mitigating oil damages and decide whether to go forward with the proposal.
- The ongoing Administration-wide response organization shares the State and local interest in a quick decision.

USACE process flow:

Permit work flow in response to Deepwater Horizon Incident
1. Pre-application meeting held (11 May)
2. Original permit application received by Corps District (12 May)
3. Interagency application review meeting held (12 May)
    a. DOI(HQ), FWS, NMFS, EPA, State of Louisiana, Consultant
4. Reviewed and disseminated proposal to Federal Agencies (12 May)
    a. Solicit comments and requested emergency consultation procedures for endangered species(12 May)
    b. Evaluate agency comments for immediate "Stoppers" (13 May)
        i. EPA review of the site barrier Island site and borrow area (veto authority)
        ii. DOI/FWS National Wildlife Refuge restrictions (restricted work)
        iii. DOI/FWS Endangered Species (comments not received)
        iv. DOI/MMS Borrow site prohibitions (informal comments on restrictions)
        v. DHS/USCG
        vi. State of Louisiana
    c. Corps Engineering Review
    If any comments require changes to the proposed project
    Example: DOI restrictions on the placement of material or the use of equipment in the National Wildlife Refuge proper required the revision of the application and resubmittal to the Corps. (13 May-Jane Lyder Deputy Assistant i@ DOI)

5. Forward all comments received to applicant (State of Louisiana, 14 May) (CURRENT STEP)
6. Revised Application submittal (expected 14 may)
    a. Re-coordination of any outstanding comments with agencies and update consultation for endangered species
    b. Evaluate agency's revised comments for immediate "Stoppers"

Repeat steps 5 and 6 as needed

7. EIS needs determination
8. Coordination with CEQ on "alternative procedures" for NEPA(if required)
9. Draft Permit Decision - Corps New Orleans Project Manager (Martin Mayer)
    a. Permit conditions will waive or require the State to Gain any other Authorizations
        i. DOI/MMS/FWS
        ii. DHS/USCG
        iii. State
10. Final Federal Agency coordination of draft permit
    a. Permit Decision Stoppers
        i. EPA Veto of the site of the barrier or borrow area
        ii. EPA Elevation (404q)
        iii. DOI/FWS Endangered Species
11. Permit Decision -Corps New Orleans District Engineer (Col. Lee)
12. Forward decision to Federal On Scene Coordinator and for approval
13. Provide to financier (BP) for acceptance
14. Applicant Gains other Authorizations as needed (may occur at any time)
15. Work may begin.

Notes from Governor's Call: Saturday May 15

Moderator: Cecelia Munoz- WH Intergovernmental Affairs

Governors: Riley, Jindal

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Additional Items:

- Attached are draft talking points and the process description of the dredging approval process that was developed by the USA COE and the NIC.

- Language Translation of documents: White House Office of Asian Affairs and the State Department (with BP) are providing translation services of documents (press releases, Q&A, etc.) into Vietnamese and other languages. Please contact Miya Chen (miya.chen@ed.gov) or Audrey Buehring at 202-453-5506 (audrey.buehring@ed.gov). They will facilitate the process with State Department translators.

Received(Date): Sat, 15 May 2010 10:56:26 -0400
From: Linda.Belton@noaa.gov
Subject: Fwd: FW: 05152010 DHR Daily External Affairs Summary
To: dwh.staff@noaa.gov
Attachment

If you already receive this please pardon. Thanks

Received(Date): Sat, 15 May 2010 09:32:48 -0400
From: HQS-PF-fldr-NIC HQ Situation Unit <NIC-HQ-Situation-Unit@uscg.mil>
Subject: FW: 05152010 DHR Daily External Affairs Summary
To: dagnew@who.eop.gov, Linda.Belton@noaa.gov, John.Berge@osec.usda.gov,Bermejo.Elmy@dol.gov, Anand_Chhabra@who.eop.gov,Jonathan_K._carson@ceq.eop.gov, Miya.Chen@ed.gov, achhabra@who.eop.gov,JCostanza@doc.gov, paul.dioguardi@hhs.gov, Lori_Faeth@ios.doi.gov,claudia.c.gelzer@uscg.dhs.gov, william.r.grawe@uscg.dhs.gov,Gray.David@epamail.epa.gov, John.Gray@noaa.gov,Georgina_M._Guernica@ceq.eop.gov, solange.o.hubble@uscg.dhs.gov,Jett@osec.usda.gov, dan.jones@sba.gov, ckammerer@who.eop.gov,joseph.loddo@sba.gov, MacDonald.Laura@dol.gov, smcgrath@who.eop.gov,McIntosh.David@epamail.epa.gov, Cecilia_Munoz@who.eop.gov,david.w.murk@uscg.dhs.gov, Gregory_S._Nelson@who.eop.gov,Oster.Seth@epamail.epa.gov, Pallone.Sarah@epamail.epa.gov, wramos@doc.gov,Amelia_S._Salzman@ceq.eop.gov, DSatcher@doc.gov, jonathan.swain@sba.gov,timothy.a.tobiasz@uscg.dhs.gov, Ver.Aaron@dol.gov, Jennifer.Yezak@usda.gov,lterrell@who.eop.gov, jheimbach@who.eop.gov, jpapa@who.eop.gov,dturton@who.eop.gov, skennedy@who.eop.gov, dwilson@who.eop.gov,smaher@who.eop.gov, lkonwinski@who.eop.gov, mortiz@who.eop.gov,"Zichal, Heather" <hzichal@who.eop.gov>, akimball@who.eop.gov,keltrich@omb.eop.gov, jmaher@ceq.eop.gov, sphadke@ceq.eop.gov,Karl.L.Schultz@uscg.dhs.gov, Daniel.J.McLaughlin@uscg.dhs.gov,christopher_mansour@ios.doi.gov, Heather_Urban@ios.doi.gov,Ganesan.Arvin@epamail.epa.gov, McIntosh.David@epamail.epa.gov, ABoyd@doc.gov,DSatcher@doc.gov, JCostanza@doc.gov, John.Gray@noaa.gov,Amanda.Hallberg@noaa.gov, elizabeth.king@osd.mil, marcel.lettre@osd.mil,michael.scionti@osd.mil, Jeff.Cashman@osd.mil, Krysta.harden@osec.usda.gov,John.Berge@osec.usda.gov, Tina.May@osec.usda.gov, Jordan.Haas@sba.gov,nicholas.coutsos@sba.gov, "Murk, David CDR" <David.W.Murk@uscg.mil>,"LaGuardia, Martha CDR" <Martha.LaGuardia@uscg.mil>,"Gelzer, Claudia CDR" <Claudia.C.Gelzer@uscg.mil>,"Tobiasz, Tim CDR" <Timothy.A.Tobiasz@uscg.mil>,"White, Casey CDR" <Casey.J.White@uscg.mil>,"O'Neil, Christopher LCDR" <christopher.t.o'neil@uscg.mil>,"White, Ryan LTJG" <Ryan.T.White@uscg.mil>
DWHR_UAC_DAILY_EXT__AFFRS_SUM_2010_05_15.doc

-----Original Message-----
From: heather.smith1@dhs.gov [mailto:heather.smith1@dhs.gov]
Sent: Saturday, May 15, 2010 9:15 AM
To: HQS-PF-fldr-NIC HQ Situation Unit
Cc: Blossom, Kellyn; Bernstein, Jarrod; Schneider, Drew; Murk, David CDR
Subject: FW: 05152010 DHR Daily External Affairs Summary

Please forward to Interagency IGA list. Thanks!

From: Smith, Heather R [mailto:heather.smith1@dhs.gov]
Sent: Saturday, May 15, 2010 8:14 AM
To: Carl Kuehn - Mobile IGA; Donaldson, Jean CDR; Clinton, Jonathan; David Gray - EPA; Gail Tate ; Glenn DaGain - BP; Heather Smith - IGA lead; Hubble, Solange; Harper, Jerald; Ensley, Kristopher LT; Kristi Watkins - Congressional/VIP; Kreischer, Jon; Lisa Hough - BP Operations Manager; Lori Faeth - Interior IGA; Miya Chen - Education; Murk, David CDR; Sara Tumen - DOI; Morrison, Stephanie LCDR; McCullough, Victoria
Subject: 05152010 DHR Daily External Affairs Summary

FOR INTERNAL USE ONLY

UNIFIED AREA COMMAND EXTERNAL AFFAIRS SUMMARY

SATURDAY, MAY 15

FLOW

As said by USCG COMDT Admiral Allen, National Incident Commander, 14May10

* Whether it's one, five, 10 or 15, our mobilization of resources is far beyond that. We're always prepared for a catastrophic event.

* We have not been contained in our resources or our tactics by flow estimates. I urge us all to remember we're operating in environment where there's no human access.

* The only parameters we have are two-dimensional video presentation and any remote sensing we can do down there.

* While all that goes on, ultimately we're going to have to know the extent of the spill to natural resources and economy.

* As far as the current response we're doing a great deal to break this slick up offshore. We're attacking it as if it were a much larger spill.

SUBSEA DISPERSANTS

* The Coast Guard and Environmental Protection Agency (EPA) announced they have authorized BP to use dispersants underwater, at the source of the Deepwater Horizon leak. The use of the dispersant at the source of the leak represents a novel approach to addressing the significant environmental threat posed by the spill.

* Oil spill dispersants are chemicals that attempt to break down the oil into small drops and prevent it from reaching the surface or the U.S. shoreline. While they are not a silver bullet, dispersants are generally less harmful than the highly toxic oil leaking from the source and they biodegrade in a much shorter time span.

* Preliminary testing results indicate that subsea use of the dispersant is effective at reducing the amount of oil from reaching the surface - and can do so with the use of less dispersant than is needed when the oil does reach the surface. This is an important step to reduce the potential for damage from oil reaching fragile wetlands and coastal areas.

* This course of action was decided upon with thorough evaluation and consideration of many factors as well as consultation with stakeholders. Because subsea use of dispersants is a novel approach, several tests were done to determine if the dispersant would be effective in breaking up the oil and helping to control the leaks.

* While BP pursues the use of subsea dispersants, the federal government will require regular analysis of its effectiveness and impact on the environment, water and air quality, and human health through a rigorous monitoring program. EPA's directive to BP, including the monitoring plan the company must adhere to in order to ensure the protection of the environment and public health, is publicly available at www.epa.gov/bpspill/dispersants.

* The federal government will work with caution and strong oversight and reserves the right to discontinue the use of this dispersant method if any negative impacts on the environment outweigh the benefits.

RISER INSERTION TUBE

* BP will attempt to install a riser insertion tube, which can capture the oil before it mixes with the water and carry it to the drillship.

* BP is also prepared to attempt to install a "top hat" dome over the main source of the leak. The "top hat" is a smaller containment dome, designed to mitigate the formation of hydrates, which prevented the success of the first containment dome. The "top hat" currently sits on the sea floor and remains an alternative choice to stop the flow.

* We said from the beginning that there is no silver bullet to stop this leak. We were moving forward from the beginning under the assumption this tactic may not be successful.

* BP will continue to drill the relief well to permanently stop the leak.

* BP and industry partners have a team of experts from across the private sector working around the clock in Houston with one responsibility: discover alternative solutions to permanently stop this leak.

* DOI Secretary Ken Salazar dispatched U.S. Geological Survey Director Marcia McNutt to oversee this process.

* On May 12, at the request of the President, Secretary Salazar and Secretary Chu traveled to Houston to participate in meetings with DOE and national lab staff, industry officials and other engineers and scientists involved in finding solutions to cap the flow of oil and contain the spill.

* Secretary Salazar and Secretary Chu conferred at the BP Command Center in Houston with teams of federal and industry scientists and engineers who are using cutting-edge technological resources and innovative ideas to find solutions to containing the oil spill and protecting Gulf Coast communities.

* They will continue to work hard to provide BP with alternative ideas.

BOOM

* As of the end of May 14, more than 1.25 million feet of containment boom has been deployed and nearly 200,000 feet of containment boom available that will continue to be strategically deployed.

* As of last night, more than 415,000 feet of sorbent boom has been deployed and more than 870,000 feet of sorbent boom available that will continue to be strategically deployed.

* We continue to work to identify additional sources of boom for delivery.

* The Coast Guard is aggressively overseeing BP efforts to ensure the appropriate type of boom is available for approved deployments as dictated by this dynamic situation.

* The Unified Command will continue to work with state, local and community leadership to ensure that needs are met and that appropriate steps are taken to stop the source of the leak, mitigate the spill and deploy the necessary resources in the Gulf.

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"As of last night there was more than 1.6 million feet of boom deployed and more than 1 million feet

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Total response vessels: 627

Containment Boom deployed: more than 1.25 million feet

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Sorbent boom available: more than 870,000 feet Boom deployed: more than 1.65 million feet (regular plus sorbent boom) Boom available: nearly 1.15 million feet (regular plus sorbent boom) Oily water recovered: more than 6.3 million gallons Dispersant used: more than 560,000 gallons Dispersant available: more than 260,000 gallons Overall personnel responding: nearly 17,500

SATURDAY, MAY 15 EVENTS (all times CST)

0815 Governors' teleconference - RADM Landry

1100 Louisiana officials - U.S. Representative Melancon, State Senators Gautreaux and Chabert, and State Representative St. Germain-will go on an overflight with CAPT Stanton

1300 DOI Secretary Salazar will visit Robert UAC and hold press conference

with ADM Landry

1400 Local Official's teleconference - CAPT Hanzalik

1400 Congressional teleconference

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TBD Senate Homeland Security Staff will visit Houma ICP

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o ADM Allen provided an update on the situation and leak stabilization efforts

o ADM Allen provided an update on operations

o FWS Deputy Asst. Secretary Sobeck provided an update on wildlife impacts

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* Governor Jindal spoke with the USCG liaison and requested additional boom for St. Tammany and Terrebonne parishes

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* Florida Attorney General McCollum visited the St. Petersburg ICP

* The Louisiana State Department of Fish and Wildlife offered vessels and personnel in support of oil spill response operations

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* USCG and BP briefed elected officials of Mobile and Baldwin Counties (AL) regarding shore clean-up plans

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June

TBD House Natural Resources STAFFDEL

Heather Smith

Intergovernmental Affairs

Deepwater Horizon Response Unified Area Command

713-323-0468

202-380-2339 cell

www.deepwaterhorizonresponse.com

www.google.com/crisisresponse/oilspill

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June

TBD	House Natural Resources STAFFDEL

If you already receive this please pardon. Thanks

Received(Date): Sun, 16 May 2010 14:11:42 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexcido Update: May 15 8 pm EDT

Gulf of Mexico Oil Spill Response Update - 05/15/2010 – 8:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;

2. On the Surface to minimize impacts of the spill; and

3. Onshore to protect the shoreline and engage the public.

Highlights

ξ 17,496 personnel responding as part of the Command, plus volunteers.

ξ Subsea dispersant application recommenced early Saturday.

ξ 14 air sorties successfully apply an additional 44,000 gallons of dispersant.

ξ 68 additional specialty response vessels at work today.

ξ 1 new claims office opens in Florida.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts. 4 vessels and 9 Remote-Operated Vehicles continue subsea work on the following operations:

1. **Riser Insertion Tube** – The riser insertion tool was brought back to the surface for a refitting. Once back on the sea floor, crews will attempt to insert the tool into the ruptured leaking riser. The riser insertion tube is connected to a drill pipe and riser that run to the Transocean *Enterprise*, on the surface. All necessary equipment is on location and engineers will move the tool back to the sea floor as soon as refitting is complete, sometime over the weekend.

2. **"Top Kill" Activities**

ξ Equipment has been fabricated and moved to location near the blowout preventer in order to work on killing the well from the top. Manifold and bypass lines are in place to provide access to valves on the

BOP. A “junk shot” of shredded fibrous material will be injected into the BOP through these lines. The objective is for the material to travel up the BOP and clog the flow of the well at the pinch point. Once the pressure is controlled, heavy fluids and cement will be pumped down the well to kill it.

ξ Diagnostics are ongoing. Gamma ray surveys are being conducted to help determine the status of internal components in the blowout preventer. Valves are being prepared to connect “choke” and “kill” lines to the manifold.

3. **Containment Recovery System**

ξ A containment dome, called a “top hat,” has been deployed to the sea floor and is readied to be placed over the main leak, if needed. It is designed with injection ports that can accommodate “anti-freeze” in order to mitigate the formation of frozen hydrates.

ξ It is important to note that this technology has never been done at this water depth. Significant technical and operational challenges must be overcome for it to be successful.

4. **Drilling relief wells** – Transocean *Development Driller III* “spudded” the first relief well on Sunday, May 2 in a water depth of roughly 5,000 feet. This relief well is one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below sea level. As of today, the well has been drilled to 9,000 feet below sea level. Casing was run and cemented to that depth. The BOP is tested and riser is being run so drilling can continue, sometime this weekend. It is estimated the total drilling process will take at least 90 days. Once that is accomplished, heavy fluids and cement can be pumped downhole to kill the well. A second relief well has been permitted and the Transocean *Development Driller II* is on location with drilling expected to begin on May 16.

5. **Dispersant injection at the sea floor** – After receiving approval from federal agencies, on Saturday, recommenced application of dispersant directly at the leak site on the sea floor using Remote Operated Vehicles (ROVs). Dispersant acts by separating the oil into small droplets that can break down more easily through natural processes before it reaches the surface. Sonar testing and aerial photographs show encouraging results. The additional subsea application is subject to ongoing testing protocols developed with the Environmental Protection Agency and other federal and state agencies.

Offshore – Surface Spill Response

ξ **Cleanup Vessels** – 627 specialty response vessels are now deployed, including tugs, barges andrecovery boats. 30 of the boats are Oil Spill Response Vessels that are designed to separate the oil from water. Approximately 151,391 barrels of oil-water mix (6.35 million gallons) have been recovered and treated.

ξ **Surface Dispersant** – 561,608 gallons of dispersant have been applied on the surface by aircraft,

with an additional 44,000 applied since Thursday. The dispersant is a biodegradable chemical that works like soap by separating the oil into small droplets that can be more easily broken down by natural processes. An additional 263,000 gallons are available for deployment. The Unified Command has three teams of vessels in place to apply dispersant on the surface, weather permitting.

- **In-Situ Burning** – The Unified Command has teams in place prepared to continue in-situ burning,depending on the weather. The in-situ burning is conducted on the surface using special fire-boom that collects surface hydrocarbons which are then burned off.

Onshore - Shoreline Protection and Community Outreach

- **$25 Million Block Grants to 4 States** – Louisiana, Florida, Mississippi and Alabama have each received a $25 million block grant. The grants were offered by BP to help local agencies upfront to implement the States' approved Area Contingency Plans. The Contingency Plans address removal of a worst case spill and are designed to mitigate or prevent a substantial threat to sensitive areas. The money will enable local businesses to immediately support clean-up and recovery efforts. <u>The grant is supplemental to BP's private claims process, which remains unchange</u>d

- **Oil Containment and Shoreline Protection** – More than 1,600,000 feet of both sorbent and barrier boom have been deployed or staged to protect sensitive coastal areas. BP is working to procure an additional 3,500,000 feet of boom. Boom is now in place or staged to protect nearly all "Tier 1" shoreline in each of the four states. Some teams are starting to work on "Tier 2" areas.

- **"Vessels of Opportunity" Program**– 3,300 applications have been approved and approximately 1,300 vessels are active – an increase of 150 since Thursday. Participating vessels are being organized into 25-boat task force teams to help with a variety of clean-up activities, including transporting supplies, performing wildlife rescue, and towing and deploying booms. To qualify for the program, operators need to meet several key requirements, including attending a four-hour hazardous waste training session, passing a dockside examination by the U.S. Coast Guard, and meeting crewing requirements based on the size of the vessel provided. The contact number for people interested in registering for the program is (281) 366-5511. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers." For additional information about training call (866) 905-4492.

- **Volunteers and Training** – BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Training ramped up significantly this week, with sessions held at multiple locations across the Gulf. As of today, more than 15,000 volunteers have been trained in five different training modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

- **Informing Community Leaders** – The Unified Command is currently holding twice-daily teleconferences with mayors and community leaders across Mississippi, Alabama and Florida to ensure that elected officials have an opportunity to be updated on Command activities and to ask questions. Additionally, BP has deployed local government affairs specialists to respond directly to local governments.

- **Wildlife Activities** – 6 additional reports of impacted wildlife. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

- **Claims for Damages** - BP has opened 13 claims offices to help claimants through the process. Vietnamese and Spanish translators are in some offices. 13,000 claims have been filed and 2,500 of them have been paid. More than $9 million has been paid out, most of which is for loss of income for commercial fishing and loss of wages. The contact number for claims is (800) 440-0858. Claims office locations are listed below.

Summary of Regional Operations and Outreach

Robert – Unified Area Command

Louisiana Sites:

Houma – Incident Command Post

Pointe A La Hache – Community Outreach Center
Venice – Community Outreach Center, Staging Area
Grand Isle – Staging Area
Port Fourchon – Staging Area
Cocodrie – Staging Area
Shell Beach – Staging Area
Slidell – Staging Area

Amelia – Staging Area
Belle Chasse – **Claims Office**

2766 Belle Chasse Hwy

Belle Chasse, LA 70037
Grand Isle – **Claims Office**

3811 LA 1

Grand Isle, LA 70358
Hammond – **Claims Office**

Worley Operations Center

303 Timber Creek

Hammond, LA 70404
Pointe A La Hache – **Claims Office**

1553 Hwy 15

Pointe A La Hache, LA
St. Bernard – **Claims Office**

1345 Bayou Rd

Saint Bernard, LA 70085
Venice – **Claims Office**

41093 Hwy LA 23

Boothville, LA 70038

- Community Outreach Centers open in 7 parishes.
- Bringing in additional adjusters to help process claims and working with translators to ensure that Vietnamese and Spanish speaking communities are served.
- Meeting with large seafood processors to determine best way to work claims.
- Continued work with parish presidents and opening new community outreach centers. Helping communities deal with increased traffic due to media and governmental interest.
- Working with Catholic Charities to deliver immediate community needs of food and clothing.
- Some fishing areas are reopening.

Mississippi Sites: Pascagoula – Community Outreach Center, Staging Area
Biloxi – Community Outreach Center, Staging Area
Waveland – Community Outreach Center
Pass Christian – Staging Area
Biloxi – **Claims Office**

920 Cedar Lake Rd, Suite K

Biloxi, MS 39532
Pascagoula – **Claims Office**

5912 Old Mobile Hwy

Suite 4

Pascagoula, MS 39563

- Community outreach centers are now in all three coastal counties.

ξ Continuing to coordinate training for vessel operators and working on Vessels of Opportunity deployment.

ξ No oil has been reported in Mississippi state waters.

Alabama Sites: Mobile – Incident Command Post, Community Outreach Center
Theodore – Staging Area
Orange Beach – Staging Area
Dauphin – Staging Area
Bayou LaBatre – **Claims Office**

290 N. Wintzell Avenue

Bayou LaBatre, AL 36509
Foley – **Claims Office**

(Orange Beach/Gulf Shores/Bon Secour)

1506 North McKenzie Street (HWY 59),

Suite 104

Foley, AL 36535

ξ Community Outreach Centers open in 2 counties.

ξ Staffing claims centers with adjusters to process claims.

ξ Working with Governor's office and non profit organizations to coordinate volunteers and identify volunteer opportunities.

Florida Sites: St. Petersburg – Incident Command Post
Pensacola – Community Outreach Center, Staging Area
Panama City – Staging Area
Ft. Walton – **Claims Office** (open Satur

348 SW Miracle Strip Pkwy
Suite 13
Fort Walton Beach, FL 32548
Gulf Breeze – **Claims Office**

5668 Gulf Breeze Pkwy

Unit B-9

Gulf Breeze, FL 32563
Pensacola – **Claims Office**

3960 Navy Boulevard

Suite 16-17

Pensacola, FL 32507

ξ Community Outreach Centers open in 7 counties.

ξ Holding townhall meetings with vessel owners and coordinating training for Vessels of Opportunity volunteers.

ξ Working with counties to engage volunteers in additional beach clean ups.

Contact Information	
Environment / Community Hotline – to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife – to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers – to request volunteer information	(866) 448-5816
Services – to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity – to report and register boats available to assist with response	(281) 366-5511
Training – for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit – email suggestions to horizonresponse@piersystem.com	
Investor Relations	(281) 366-3123
Claims	(800) 440-0858
Joint Information Center – Media and governmental inquiries	(985) 902-5231 or (985) 902-5240
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765
BP Family – and third-party contractor hotline	(281) 366-5578
Twitter: Oil_Spill_2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

BP America

Sr. Director, Regulatory Affairs

(202) 457-6594

(202) 351-1399 (cell)

stjohnk@bp.com

Received(Date): Sun, 16 May 2010 09:49:37 -0400
From: Beth Dieveney <Beth.Dieveney@noaa.gov>
Subject: May 16 NOAA Deepwater Horizon Call Actions
To: Deepwater <Deepwater.HorizonDist@noaa.gov>

For Official Use Only/Not for Public Release

NOAA Daily DeepWater Horizon Call
Sunday, May 16, 2010
[redacted]

Call Guidelines:

- Place your phone on mute at all times unless you are speaking
- **Do not** place your phone on hold

Action Items

- Verify how long has NOAA had access to BP video (Miller)
- Follow-up on NOAA representation at NIC and if Mark Miller and Ralph Lopez need additional support (Miller to assess with leadership)
- Communication plan for loop current, ensure have same story for all constituents. Talking points for leadership (Kenney)
  - Identify Loop current team of experts for media outreach: Murawski, Lubchenco
- Move loop current one-pager through clearance ASAP (Murawski/Dieveney/leadership clearance)
- Change loop current map: oil portion stippled to indicate that the oil is not uniform across the spill, show loop current as a somewhat more varied flow (Haddad)
- Tuesday, 2-3 meeting hosted by OMB for bi-cameral Congressional meeting to review legislation that has been introduced – who should participate on behalf of NOAA (Spring/NMFS(Reisner)/NOS (Westerholm and Kennedy)
- Formal request needed through NIC for chemical components of dispersants, assistance from GC if needed (Miller/Lopez)
- Dispersant Monitoring plan should include efficacy of dispersant on oil, and biological/ecological impacts (Gallagher to follow-up with Henry/Lehmann)
- Status of request for Gordon Gunther (Gallagher)
- LA Barrier Island dredge and fill proposal (follow-up call on Monday 10 am Croom and Doley to participate)
- Hurricane outlook interactions with oil spill talking points and Tuesday 8am briefing (NWS)

Documents cleared through WH clearance process for 5/11/10
(currently, this list is incomplete but will be updated on a daily basis)

FACT SHEETS – CLEARED & POSTED ONLINE

- Booms

- Coral reefs & oil
- Marine mammals and sea turtles
- Gulf of Mexico Oil Spill General (Fish)
- Fish stocks in the Gulf of Mexico
- Seafood safety
- Impact of crude oil on seafood
- Natural Resources Damage Assessment
- Shorelines and coastal habitats in the Gulf of Mexico
- Dispersants (OR&R sheet)
- Shoreline & habitats (OR&R sheet)
- Shoreline Cleanup and Assessment Technique (SCAT) (OR&R sheet)

FACT SHEETS – IN CLEARANCE/WORK

- Sheen (cleared/not posted)
- Oil weathering/types
- Loop current
- Mussel Watch
- NOS activities
- Hypoxia (dead zone) & oil

Websites for more information:
OR&R Response Outreach – http://response.restoration.noaa.gov/deepwaterhorizon (cleared fact sheets)
Deepwater Horizon JIC – www.deepwaterhorizonresponse.com (cleared factsheets)
ResponseLink – https://responselink.orr.noaa.gov
NOAA ICC Sitreps - https://www.homelandsecurity.noaa.gov/icc_sitreps.html
Updates on Fisheries Closure – http://sero.nmfs.noaa.gov/
Daily updates to NOAA nautical charts: http://www.nauticalcharts.noaa.gov/.

Joint Information Center Contacts (as of 5/11/10)
David Miller / 202-329-4030 (LA) david.p.miller@noaa.gov (through Monday, May 17th)
Connie Barclay / 202-441-2398.
Rachel Wilhelm / 202-657-9816.

NOAA Scientific Scientist Coordination on site (as of 5/7/10)
Charlie Henry (206-849-9928) - Robert
Steve Lehman (617-877-2806) - Robert
Jordan Stout (206-321-3320) - Houma
John Tarpley (206-526-6338) - Houma
Mary Gill (206-849-9953) - Mobile
Ruth Yender (206-89-9926) - Mobile
Brad Benggio (206-849-9923) - St. Pete

Carl Jochums – NOAA contractor boom expert on site.
Beth Dieveney
NOAA Program Coordination Office

Office of the Under Secretary
14th & Constitution Ave., NW, Room 5811
Washington, DC 20230

phone: 202 482 1281
cell: 240 328 4812
fax: 202 482 4116

Received(Date): Mon, 17 May 2010 12:50:22 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update: May 16

On Sunday, an important step was reached in containing and reducing the amount of oil being released into the Gulf of Mexico.

Overnight the riser insertion tube tool was successfully tested and inserted into the leaking riser, capturing some oil and gas. Although the test was temporarily halted when the tube was dislodged, we have since re-inserted the tool and are currently processing oil and gas onboard the Discoverer Enterprise drill ship five thousand feet above on the water's surface. The natural gas is being burned through a flare system on the ship and the oil will be shipped to shore and processed. We will continue to optimize the containment system over time.

Plans to stop the flow of oil in the blowout preventer continue and we hope to move forward with these options in the next 7-10 days.

In addition, we have been authorized by the US Coast Guard and the U.S. Environmental Protection Agency to use subsea dispersants at the source of the leak. Upon thorough evaluation, the chemical has been found to be effective in breaking up the oil and reducing the amount of oil on the surface.

Work on the second relief well began today on the Development Driller II and progress continues to be made on the first relief well.

Other tactics to remove oil from the water surface using booming, skimming, and controlled burn operations are ongoing as favorable weather permits.

Incident Update:

ξ More than 1.7 million feet of boom (barrier) has been deployed to contain the spill.

ξ To date, the oil spill response team has recovered 6.3 million gallons of oil-water mix.

ξ More than 656 total response vessels are being used including skimmers, tugs, barges and recovery vessels.

ξ Approximately 19,000 personnel are responding overall.

ξ 17 staging areas are in place and ready to protect sensitive shorelines along Louisiana, Mississippi, Alabama, and Florida coastline.

Karen St John

BP America

Sr. Director, Regulatory Affairs

(202) 457-6594

(202) 351-1399 (cell)

stjohnk@bp.com

Received(Date): Mon, 17 May 2010 10:49:23 -0400
From: Beth Dieveney <Beth.Dieveney@noaa.gov>
Subject: May 17 NOAA Deepwater Call Actions
To: deepwater <Deepwater.HorizonDist@noaa.gov>

For Official Use Only/Not for Public Release

NOAA Daily DeepWater Horizon Call
Monday, May 17, 2010
[redacted] b6

Call Guidelines:

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Action Items

- Develop talking points for issue of Pelican cruise and scientific statements asserted in press (Kenney/McLean)
- Line Office assess participation in 3 technical working groups that are stood up by the Interagency Solutions group (LO leadership - see below for details on working groups and ORR identified technical participants)
- Concerted effort to reach out to the academic community; elevate the science that is informing the actions in a more open and transparent way; work with other agencies through NIC process to engage/reach out to scientists. Small team to brainstorm how to engage other agencies and academic community. (Use Interagency Coordinating Committee for Oil Spill Research (under OPA) and UNH; involve OSTP, NIST, USGS, Chu, Holdren). Develop proposal for review today. (Murawski/Conner, others as appropriate)
- Reconsider fisheries closure in light of data provided from Pelican cruise. Also conducting random dock-side sampling to ensure seafood safety. (Oliver/Murawksi/NMFS)
- Expedited review of Loop 101 and Talking Points – internal by 0930
- Expedited review of Long-Term Transport of Oil and Talking Points – internal by 1100
- Return to discussion regarding how much dispersant is too much (issue for Science Summit)
- Follow-up on request for BP video (Conner to follow-up with Steve Lehmann and determine next steps, Spring to follow-up with DHS)

Significant Issues to Note

Interagency Solutions Working Group – ADML Allen established this group to have better access to Federal agency technical expertise. Majority of issues brought to this group are NOAA related issues.
Today, they Establish 3 work teams

- Discharge Rate technical team – potential participants: Dr. Bill Lehr, OAR (Dr. Ned Cokelet, PMEL)

- Loop current team – potential participants: Dr. Jerry Galt, Dr. Rich Patchen (Environmental Assessment Group has also taken this issue on)
- Subsea Dispersant Characteristics – potential participants: Dr. CJ Beegle-Krausen, Dr. Alan Mearns

Broader NOAA participation – propose that OAR join the team of NOAA staff at the NIC; this individual would sit at the NIC

Documents cleared through WH clearance process for 5/11/10
(currently, this list is incomplete but will be updated on a daily basis)

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- Booms
- Coral reefs & oil
- Marine mammals and sea turtles
- Gulf of Mexico Oil Spill General (Fish)
- Fish stocks in the Gulf of Mexico
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- Dispersants (OR&R sheet)
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- Shoreline Cleanup and Assessment Technique (SCAT) (OR&R sheet)

FACT SHEETS – IN CLEARANCE/WORK

- Sheen (cleared/not posted)
- Oil weathering/types
- Loop current
- Mussel Watch
- NOS activities
- Hypoxia (dead zone) & oil

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Deepwater Horizon JIC – www.deepwaterhorizonresponse.com (cleared factsheets)
ResponseLink – https://responselink.orr.noaa.gov
NOAA ICC Sitreps - https://www.homelandsecurity.noaa.gov/icc_sitreps.html
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Connie Barclay / 202-441-2398.
Replacement: Rachel Wilhelm arrives Sat., May 15th / 202-657-9816.

NOAA Scientific Scientist Coordination on site (as of 5/7/10)
Charlie Henry (206-849-9928) – Robert
Frank Csulak - Houma
Mary Gill (206-849-9953) - Mobile
Ruth Yender (206-89-9926) – Mobile
John Whitney - Mobile
Brad Benggio (206-849-9923) - St. Pete
LTJG Josh Slater – Venice, LA
Mark Miller - NIC

Carl Jochums – NOAA contractor boom expert on site.

Beth Dieveney
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Received(Date): Mon, 17 May 2010 13:04:15 -0400
From: Justin Kenney <Justin.kenney@noaa.gov>
Subject: Lubchenco statement on R/V Pelican
To: _NOAA HQ leadership <NOAAHQ.Leadership@noaa.gov>,"Deepwater Staff (dwh.staff@noaa.gov)" <dwh.staff@noaa.gov>,David Kennedy <David.Kennedy@noaa.gov>,"dave.westerholm@noaa.gov" <Dave.Westerholm@noaa.gov>
image001.png

In response to media reports about a NOAA-funded research cruise on the R/V Pelican, Dr. Jane Lubchenco, NOAA administrator, issued the following statement:

"Media reports related to the research work conducted aboard the R/V Pelican included information that was misleading, premature and, in some cases, inaccurate. Yesterday the independent scientists clarified three important points:

1. No definitive conclusions have been reached by this research team about the composition of the undersea layers they discovered. Characterization of these layers will require analysis of samples and calibration of key instruments. The hypothesis that the layers consist of oil remains to be verified.

2. While oxygen levels detected in the layers were somewhat below normal, they are not low enough to be a source of concern at this time.

3. Although their initial interest in searching for subsurface oil was motivated by consideration of subsurface use of dispersants, there is no information to connect use of dispersants to the subsurface layers they discovered.

NOAA congratulates the Pelican scientists and crew for repurposing their previously scheduled mission to gather information about possible impacts of the BP oil spill. We eagerly await results from their analyses and share with them the goal of disseminating accurate information

NOAA continues to work closely with EPA and the federal response team to monitor the presence of oil and the use of surface and sub-surface dispersants. As we have emphasized, dispersants are not a silver bullet. They are used to move us towards the lesser of two environmental outcomes. Until the flow of oil is stemmed, we must take every responsible action to reduce the impact of the oil."

Justin Kenney

NOAA Director of Communications & External Affairs

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Cell: 202-821-6310

Email: justin.kenney@noaa.gov

STAY CONNECTED

http://www.noaa.gov/socialmedia/

STAY CONNECTED

YouTube

Received(Date): Mon, 17 May 2010 16:19:03 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: FW: Tueday pre-brief call at 9:05
To: dwh.staff@noaa.gov, 'John Gray' <John.Gray@noaa.gov>,'Monica Medina' <Monica.Medina@noaa.gov>,'Sally Yozell' <Sally.Yozell@noaa.gov>,'Amanda Hallberg Greenwell' <Amanda.Hallberg@noaa.gov>,'Margaret Spring' <Margaret.Spring@noaa.gov>
Cc: 'Justin kenney' <Justin.kenney@noaa.gov>

· Here are the notes from this morning's Governor's call and the agenda for Tuesday's call.

· **Sally, would you be able to lead participate in this week's calls? If not, dwh.staff, please advise on suggested NOAA principal.**

· It would be great if David Kennedy or Dave Westerholm (or both) could join again to discuss the loop current.

· **During WH-IGA 10:00am call, it has been suggested that because of the recent reports on the current, that there be another briefing to the Atlantic coast Governors this week.**

Notes and action items from today's Governors call:

· Administrator Jackson – discussed the recent reports by scientists of giant dispersal plumes of subsea oil. The Administrator said we are in the process now of balancing that academic science with real world facts. We are tracking the scientists' data closely, and trying to verify their conclusions. It may be 1-2 weeks before we know the answers, but we are fast-tracking our analysis. NOAA and EPA are coordinating. Action: Updates between now and when the final analysis is completed.

· Adm. Neffenger – gave the regular report on the leak stabilization efforts. This will continue to be an important update over the next few days.

· Adm. Landry – said weather conditions will allow burns, skimming and dispersants application over the next few days. Action: updates on the success of these actions.

· Adm. Landry— discussed the crab pot/dip stick testing of sub-surface oil. Given the weather, we should be able to conduct this testing. Action: update on the success of the sampling efforts and the findings.

· Adm. Landry— mentioned that we have changed our visible imprint on the beaches, i.e., not using haz mat suits unless it is called for. Action: Communicate this information to Gov. Riley.

· Adm. Landry— mentioned that boom deployment has continued, including westward as requested by Gov. Jindal. (Jindal did not raise the issue of more boom today for the first time. Is he now satisfied?)

· **Loop Current – Adm. Landry/NOAA discussed the loop current. Action: We need to continue to watch this closely, and keep Governors apprised. (There is a request from WH IGA to update the Atlantic Coast Governors)**

· Sobeck— said wildlife crews were not able to get out much over the weekend. They should be able to get out in the coming days. Action: continued update on their findings.

· Dept. of Labor/OSHA— reported on workforce issues, worker training, and translation. Action: can we send the Governors written materials on the information presented on the call?

Tuesday, May 18 Call with Governors

9:05 a.m. pre-brief; 9:15 Governors

[redacted]

HOST Pi [redacted] – Speakers

Please limit participation in the pre-conference to speakers and essential staff.

DRAFT AGENDA

-

· Opening remarks (Valerie Jarrett)

· EPA Update – **EPA Administrator Lisa Jackson (or Dep Admin Bob Perciasepe)**

o Discussed the recent reports by scientists of giant dispersal plumes of subsea oil. The Administrator said we are in the process now of balancing that academic science with real world facts. We are tracking the scientists' data closely, and trying to verify their conclusions. It may be 1-2 weeks before we know the answers, but we are fast-tracking our analysis. NOAA and EPA are coordinating. Action: Updates between now and when the final analysis is completed.

· Observations and Trajectory-**NOAA**

o NOAA will provide the latest observations and trajectories

o Loop Current – There was a lot of discussion by Landry/NOAA about the loop current. Action: We need to continue to watch this closely, and keep Governors apprised. **(WH-IGA would like to brief the Atlantic Coast Governors with an update this week)**

· Situation and Leak Stabilization Update – **Adm Landry and Adm Watson**

o Latest information from National Incident Command, including current status of efforts to stabilize the leaks.

· Operations Report –**Adm Landry Landry and Adm Watson, UAC**

o Response Plans and Boom

o Landry – said weather conditions will allow burns, skimming and dispersants application over the next few days. Action: updates on the success.

o Landry— discussed the crab pot/dip stick testing of sub-surface oil. Given the weather, we should be able to conduct this testing. Action: update on the success of the sampling efforts and the findings.

o Landry— mentioned that we have changed our visible imprint on the beaches, i.e., not using haz mat suits unless it is called for. Action: Communicate this information to Gov. Riley.

o Landry— mentioned that boom deployment has continued, including westward as requested by Gov. Jindal. (Jindal did not raise the issue of more boom today for the first time. Is he now satisfied?)

· Wildlife Impacts – **Eileen Sobeck, FWS**

o Wildlife crews were not able to get out much over the weekend. They should be able to get out in the coming days. Action: continued update on their findings.

· Fisheries Closures and Seafood Safety (if there is an update) **– NOAA**

· Open discussion and Q&A with Governors and state officials

· Next call – 9:15 a.m. EDT (8:15 CDT) Monday, May 18, 2010

-

Received(Date): Tue, 18 May 2010 14:20:02 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update: May 17, 2010

Please let me know if you have any questions. Karen (contact details at the end)

Gulf of Mexico Oil Spill Response Update

05/17/2010 – 9:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;
2. On the Surface to minimize impacts of the spill; and
3. Onshore to protect the shoreline and keep the public informed.

Highlights

ξ 17,159 personnel responding as part of the Command, plus volunteers.

ξ Riser Insertion Tube successfully deployed to collect oil at the primary leak.

ξ Drilling begins on second relief well.

ξ BP makes additional $70 million available to states to support tourism.

ξ Subsea dispersant application resumed, 7,500 gallons injected on Sunday.

ξ 80 additional specialty response vessels at work today.

ξ Four new claims centers open – More than $11 million in claims paid.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts. 8 Remote-Operated Vehicles continue subsea work on the following operations:

1. **Riser Insertion Tube** – The riser insertion tool was successfully placed into the leaking riser and the tube is capturing some of the oil and gas. This remains a new technology and both its continued operation and its effectiveness in capturing the oil and gas remain uncertain.

2. **"Top Kill" Activities**

ξ Equipment has been fabricated and moved to location near the blowout preventer in order to work on killing the well from the top. Manifold and bypass lines are in place to provide access to valves on the BOP. Through these valves, engineers will attempt first to pump heavy fluids and cement directly downhole to kill the well.

ξ An additional option to control pressure is to inject a "junk shot" of shredded fibrous material into the BOP through these lines. The material will travel up the BOP and clog the flow of the well. Once the pressure is controlled, heavy fluids and cement can then be pumped down the well to kill it.

ξ Diagnostics are ongoing. Surveys have been conducted to determine the status of internal components and pressures inside the blowout preventer.

3. **Dispersant injection at the sea floor** – Application of dispersant directly at the leak site on the sea floor resumed on Sunday. 7,500 gallons were applied using Remote Operated Vehicles (ROVs). The dispersant acts by separating the oil into small droplets that can break down more easily through natural processes before it reaches the surface. Sonar testing and aerial photographs show encouraging results. The additional subsea application is subject to ongoing testing protocols developed with the Environmental Protection Agency and other federal and state agencies.

4. **Drilling relief wells** – On Sunday, Transocean's drillship, *Development Driller II,* began drilling the second relief well. Like the first relief well, this one is approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. The first relief well was "spudded" by Transocean *Development Driller III* on Sunday, May 2, in a water depth of roughly 5,000 feet. This well has been drilled to 9,000 feet below sea level. It has been cased and cemented to that depth. Testing of the BOP is continuing and drilling should resume again within a couple of days. It is estimated the total drilling process will take at least 90 days. Once that is accomplished, and the original well has been penetrated, heavy fluids and cement can be pumped downhole to kill the well.

5. **Containment Recovery System**

ξ A containment dome, called a "top hat," has been deployed to the sea floor and is ready to be placed over the main leak, if needed. It is designed with injection ports that can accommodate "anti-freeze" in order to mitigate the formation of large volumes of frozen hydrates.

ξ It is important to note that this technology has never been used at this water depth. Significant technical and operational challenges must be overcome for it to be successful.

Offshore – Surface Spill Response

ξ **Cleanup Vessels** – 720 specialty response vessels are now deployed, including tugs, barges andrecovery boats. 32 of the boats are Oil Spill Response Vessels that are designed to separate the oil from water. Approximately 158,370 barrels of oil-water mix (6.65 million gallons) have been recovered and treated.

ξ **Surface Dispersant** – 582,608 gallons of dispersant have been applied on the surface by aircraft, including an additional 20,000 applied on Sunday. The dispersant is a biodegradable chemical that works like soap by separating the oil into small droplets that can be more easily broken down by natural processes. An additional 390,000 gallons are available for deployment.

ξ **In-Situ Burning** – The Unified Command has teams in place prepared to continue in-situ burning, depending on the weather. The in-situ burning is conducted on the surface using special fire-boom that collects surface hydrocarbons which are then burned off.

Onshore - Shoreline Protection and Community Outreach

ξ **BP Announces $70 million in Tourism Grants to States** – On Monday, BP CEO Tony Hayward announced the company will make an additional $70 million available to Gulf Coast states to promote tourism. The company will give $25 million to Florida and $15 million each to Alabama, Mississippi and Louisiana. The grants are in response to governors' concerns that the tourism industry is being impacted. It will be used to promote area tourism and to provide accurate information about beach impacts. This money is in addition to the $100 million block grants for accelerated implementation of Area Contingency Plans announced on May 4. It is also supplemental to BP's private claims process, which remains unchanged.

ξ **$25 Million Block Grants to 4 States** – On May 4, BP announced it would provide Louisiana, Florida, Mississippi and Alabama $25 million each to accelerate implementation of the States' approved Area Contingency Plans. The Contingency Plans address removal of a worst case spill and are designed to mitigate or prevent a substantial threat to sensitive areas. The money will enable local businesses to immediately support clean-up and recovery efforts. The grant is supplemental to BP's private claims process, which remains unchanged.

ξ **Oil Containment and Shoreline Protection** – More than 1,700,000 feet of both sorbent and barrier boom have been deployed or staged to protect sensitive coastal areas. BP is working to procure an additional 3,500,000 feet of boom. Boom is now in place or staged to protect nearly all "Tier 1" shoreline in each of the four states. Some teams are starting to work on "Tier 2" areas.

- **"Vessels of Opportunity" Program** – 3,962 applications have been approved and approximately 1,330 vessels are active and being paid. Participating vessels are being organized into 25-boat task force teams to help with a variety of clean-up activities, including transporting supplies, performing wildlife rescue, and towing and deploying booms. To qualify for the program, operators need to meet several key requirements, including attending a four-hour hazardous waste training session, passing a dockside examination by the U.S. Coast Guard, and meeting crewing requirements based on the size of the vessel provided. The contact number for people interested in registering for the program is (281) 366-5511. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers." For additional information about training call (866) 905-4492.

- **Volunteers and Training** – BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Training ramped up significantly this week, with sessions held at multiple locations across the Gulf. As of today, more than 15,000 volunteers have been trained in five different training modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

- **Informing Community Leaders** – The Unified Command continues to hold twice-daily teleconferences with mayors and community leaders across Mississippi, Alabama and Florida to ensure that elected officials have an opportunity to be updated on Command activities and to ask questions.

- **Wildlife Activities** – 3 additional reports of impacted wildlife were received, bringing the total to 35. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

- **Claims for Damages** - BP has opened 14 claims offices to help claimants through the process. Vietnamese and Spanish translators are in some offices. 15,600 claims have been filed and approximately 2,700 of them have been paid. More than $11 million has been paid out – an increase of $2 million since Saturday – most of which is for loss of income or wages in commercial fishing. The contact number for claims is (800) 440-0858. Claims office locations are listed below.

Summary of Regional Operations and Outreach

Robert – Unified Area Command

Louisiana Sites:

Houma – Incident Command Post

Pointe A La Hache – Community Outreach Center

Venice – Community Outreach Center, Staging Area

Grand Isle – Staging Area

Port Fourchon – Staging Area

Cocodrie – Staging Area

Shell Beach – Staging Area

Slidell – Staging Area

St. Mary – Staging Area

Amelia – Staging Area

Belle Chasse – **Claims Office**

2766 Belle Chasse Hwy

Belle Chasse, LA 70037

Cut Off – **Claims Office**

Tarpon Heights Shopping Center

Unit 2

16263 E. Main Street

Cut Off, LA 70345

Grand Isle – **Claims Office**

3811 LA 1

Grand Isle, LA 70358

Hammond – **Claims Office**

Worley Operations Center

303 Timber Creek

Hammond, LA 70404

Pointe A La Hache – **Claims Office**

1553 Hwy 15

Pointe A La Hache, LA

St. Bernard – **Claims Office**

1345 Bayou Rd

Saint Bernard, LA 70085

Venice – **Claims Office**

41093 Hwy LA 23

Boothville, LA 70038

- Community Outreach Centers now open in 8 parishes.
- New Staging Area opened at St. Mary.
- New Claims Office for Lafourche Parish opened at Cut Off.
- Bringing in additional adjusters to help process claims and working with translators to ensure that Vietnamese and Spanish speaking communities are served.
- Town hall meeting in Belle Chasse.
- Working with Catholic Charities to deliver immediate community needs of food and clothing.

Mississippi Sites: Pascagoula – Community Outreach Center, Staging Area
Biloxi – Community Outreach Center, Staging Area
Waveland – Community Outreach Center
Pass Christian – Staging Area

Biloxi – **Claims Office**

920 Cedar Lake Rd, Suite K

Biloxi, MS 39532

Pascagoula – **Claims Office**

5912 Old Mobile Hwy

Suite 4

Pascagoula, MS 39563

- Community outreach centers are now open in all three coastal counties.
- Continuing to coordinate training for vessel operators and working on Vessels of Opportunity deployment.

Alabama Sites: Mobile – Incident Command Post, Community Outreach Center
Theodore – Staging Area
Orange Beach – Staging Area
Dauphin – Staging Area

Bayou LaBatre – Claims Office

290 N. Wintzell Avenue

Bayou LaBatre, AL 36509

Foley – **Claims Office**

(Orange Beach/Gulf Shores/Bon Secour)

1506 North McKenzie Street (HWY 59),

Suite 104

Foley, AL 36535
Gulf Shores / Orange Beach – **Claims Office**

24039 Perdido Beach Blvd

Suite 1

Orange Beach, AL 36561

- Community Outreach Centers now open in 2 counties.
- New Claims Office for Baldwin County opened at Orange Beach.
- Staffing claims centers with adjusters to process claims, looking at opening additional claims offices.

Florida Sites: St. Petersburg – Incident Command Post
Pensacola – Community Outreach Center, Staging Area
Panama City – Staging Area
St. Joe – Staging Area
St. Marks – Staging Area
Ft. Walton – **Claims Office** (open Saturday)

348 SW Miracle Strip Pkwy
Suite 13
Fort Walton Beach, FL 32548

Gulf Breeze – **Claims Office**

5668 Gulf Breeze Pkwy

Unit B-9

Gulf Breeze, FL 32563
Panama City – **Claims Office**

7938 Front Beach Road

Panama City Beach, FL 32408
Pensacola – **Claims Office**

3960 Navy Boulevard

Suite 16-17

Pensacola, FL 32507

ξ Community Outreach Centers are now open in 7 counties.

ξ New Staging Areas at St. Joe and St. Marks.

ξ New Claims Office for Bay County opened at Panama City Beach.

ξ Holding town hall meetings with vessel owners and coordinating training for Vessels of Opportunity volunteers.

ξ Working with counties to review Area Contingency Plans and identify booming and beach clean up priorities.

Contact Information

Environment / Community Hotline – to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife – to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers – to request volunteer information	(866) 448-5816
Services – to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity – to report and register boats available to assist with response	(281) 366-5511
Training – for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit – email suggestions to horizonresponse@piersystem.com	
Investor Relations	(281) 366-3123
Claims	(800) 440-0858
Joint Information Center – Robert, LA – Media and information center	(985) 902-5231 or (985) 902-5240
Joint Information Center – Mobile, AL – Media and information center	(251) 445-8965
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765
BP Family – and third-party contractor hotline	(281) 366-5578
Twitter: Oil_Spill_2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

BP America

Sr. Director, Regulatory Affairs

(202) 457-6594

(202) 351-1399 (cell)

stjohnk@bp.com

Received(Date): Tue, 18 May 2010 11:53:12 -0400
From: Beth.Dieveney@noaa.gov
Subject: May 18 NOAA Deepwater Horizon Call Actions
To: Deepwater.HorizonDist@noaa.gov
task list-5-18-10.xlsx

For Official Use Only/Not for Public Release
NOAA Daily DeepWater Horizon Call
Tuesday, May 18, 2010; 0800
[redacted] b6

Call Guidelines:
·Place your phone on mute at all times unless you are speaking
·Do not place your phone on hold

Additional Attachments
Task list record of actions from 0800 Daily NOAA calls as of 5/18 (this is for reference only)

Action Items
·Follow-up on research platforms that could be deployed and sampling plan from all assets (Murawski and team, report in advance of afternoon testimony)
·Expert briefing for Loop Current (Kenney)
·Histogram by day for turtle strandings (NMFS)
·Request for talking points for turtle strandings (NMFS)
·Precautionary closure of fisheries due to potential of oil in the loop current (NMFS)
·Assign technical point for OMB, DOC, FDA group regarding seafood safety; Steve Wilson and Tim Hansen can serve this role.
·Need to have talking points and alert Cuba and Mexico regarding fishe
ry closure and potential of oil in loop current (Turner)
·Alert WH of fishery closure change (Sarri)
·Talking points on loop current, fishery closure, international, states – what we are doing to address the potential that oil is in the loop current (Murawski, Mclean, Turner to send to Kenney by 10am)

Documents cleared through WH clearance process for 5/11/10 (currently, this list is incomplete but will be updated on a daily basis)

FACT SHEETS – CLEARED & POSTED ONLINE
·Booms
·Coral reefs & oil
·Marine mammals and sea turtles
·Gulf of Mexico Oil Spill General (Fish)
·Fish stocks in the Gulf of Mexico ·Seafood safety
·Impact of crude oil on seafood ·Natural Resources Damage Assessment
·Shorelines and coastal habitats in the Gulf of Mexico
·Dispersants (OR&R sheet)
·Shoreline & habitats (OR&R sheet)
·Shoreline Cleanup and Assessment Technique (SCAT) (OR&R sheet)

FACT SHEETS – IN CLEARANCE/WORK
·Sheen (cleared/not posted)
·Oil weathering/types
·Loop current
·Mussel Watch
·NOS activities
·Hypoxia (dead zone) & oil

Websites for more information:

OR&R Response Outreach – http://response.restoration.noaa.gov/deepwaterhorizon (cleared fact sheets)
Deepwater Horizon JIC – www.deepwaterhorizonresponse.com (cleared factsheets)
ResponseLink – https://responselink.orr.noaa.gov
NOAA ICC Sitreps - https://www.homelandsecurity.noaa.gov/icc_sitreps.html
Updates on Fisheries Closure – http://sero.nmfs.noaa.gov/
Daily updates to NOAA nautical charts: http://www.nauticalcharts.noaa.gov/.

Joint Information Center Contacts (as of 5/11/10)
David Miller / 202-329-4030 (LA) david.p.miller@noaa.gov (through Monday, May 17th)
Monica Allen (NOAA Fisheries Communications) is there this week (5/15-20). Her cell # is 202/379-6693.
Replacement: Rachel Wilhelm arrives Sat., May 15th / 202-657-9816.NOAA Scientific Scientist
Coordination on site (as of 5/17/10) Charlie Henry (206-849-9928) – Robert, LA
LCDR Demian Bailey (206-518-1941) - Robert, LA
Ed Levine (206-849-9941) - Houma, LA
Jordon Stout (206-321-3320) - Houma, LA
Frank Csulak (732-371-1005) - Houma, LA Ruth Yender (206-849-9926) – Mobile, AL
LCDR Liz Jones (206-849-9918) - Mobile, AL John Whitney (907-440-8109)- Mobile, AL Brad Benggio (206-849-9923) - St. Petersburg, FL LTJG Josh Slater (206-462-0710) – Mobile, AL Mark Miller (206-713-0640) - NIC, Washington DC
Carl Jochums – NOAA contractor boom expert on site.

TASK	DEADLINE	LEAD
litigation hold on all documenets	on-going	ALL
talking points/on-pager Impacts to marine mammals and turtles	4/27/2010	NMFS
Fisheries report and economic statistics	4/28/2010	James
Role, Schedule document	4/29/2010	Dieveney
Email Distribution List	4/29/2010	Love
fishery closure disaster FAQs (can fishermen receive compensation near real-time?)	4/29/2010	NMFS
Request for economic impacts to fisheries	4/29/2010	
fisheries issues white paper as relates to spill	4/29/2010	NMFS through ICC
Develop a long-term staffing plan	4/30/2010	Moore
White House White paper - OCS and OSLTF	4/30/2010	Lukens, Bavishi, Holst
Develop plan for ICC to be 24 hrs	4/30/2010	Moore
Use of Satellite Imagery	4/30/2010	Holst
oil spill impacts, hurricances, and other weather systems	4/30/2010	NWS
provide trajectory information to DOT	4/30/2010	ICC
List of NMAO vessels in area	4/30/2010	Taggert
Impacts to NOAA equipment (tide guages, etc)	4/30/2010	Moore
Unified Command locations	4/30/2010	Holst
Map of NOAA facilities in area	4/30/2010	Taggart
contact info to send new ideas/technologies	4/30/2010	ORR
Worst Case Scenario briefing for Deputies	5/1/2010	Conner, Helton
assessment of historical weather in Gulf	5/1/2010	NWS
Prioritized list of Congressional of overflights	5/1/2010	Gray, Bagley
policy decision -economic implications for WH	5/1/2010	Doremus
Winer to serve as POC for NGO engagement	5/1/2010	Winer
Resources at Risk and accompanying FAQs about roles responsibiliites, and what we are actually doing	5/1/2010	NMFS
follow-up with UNH science contacts, particularly in relation to dispersants	5/1/2010	kennedy request
one-pager biological impact from sheen and dispersants	5/2/2010	Holst
NOAA role in oil spills	5/3/2010	Holst
Turtle talking points	5/3/2010	NMFS
legal record of use of dispersant at source	5/3/2010	ORR
work force mgt explore how to engage support of other agencies, states, etc	5/3/2010	Taggart
Contingency Plan for Gordon Gunther	5/3/2010	OMAO
Official Tasking for vessel allocation	5/4/2010	Conner
Loop Current Tps	5/4/2010	ORR Seattle
Verify NIST engaged in specimen collection	5/4/2010	ORR

understanding of safety of environment	5/4/2010	Broglie
Safety of staff working on the ground	5/4/2010	Nyr B
catch & release in closed area tps	5/4/2010	NMFS
recreational & commercial fishing data	5/4/2010	James, Plummer
NASA to provide high spectral imaging	5/4/2010	Glackin
Legal questions for response to Governors	5/4/2010	Schiffer, GC
LO engagement training fishermen	5/4/2010	PCO
loop current factsheet	5/5/2010	ORR Seattle
High level worst case tps	5/5/2010	Holst
worst case web-ex meeting	5/5/2010	Conner
partner with google on product	on-going	Klimavicz, Akamine
NMFS updated info available for Govs. Calls	5/6/2010	NMFS, Rapp
best case scenario	5/6/2010	Conner
Request from DOI for assistance in chain of custody, storage procedures, laboratories that can do anaylysis, etc.	5/6/2010	NIST/Pedro Espina
Review EPA Dispersant Q&A	5/7/2010	Holst, ORR
info on how volunteers can get involved	5/7/2010	Madsen
mechanism for small grants to academics	5/7/2010	
Briefing for Francis Beinecke, CEO NRDC	5/7/2010	Winer
industry validator list for efforts in Gulf for Adm Allen phone call on 4/9	5/8/2010	Winer

Q&A on Sea Food Safety - NOAA/FDA authorities, roles, on-ground coordination, NMFS	5/9/2010	NMFS
Assess NOAA to serve as lead for SCATs	5/9/2010	Conner
Compacted oil bricks collected at Dauphin Island, what NOAA scientist received, what info is known	5/9/2010	Conner
NOAA all hands message on gulf	5/9/2010	Kenney
Rep. Cassidy requested info on testing/monitoring of the impacted fisheries areas and how it is determined what areas should be closed (or re-opened) and how that information is relayed with the public.	5/9/2010	OLA/NMFS
analysis of "red-tide" samples	5/9/2010	ORR
NOAA Research Council oil and science coordination across NOAA; outcome actions for team and Larry Robinson	5/9/2010	Murawski
Gov. LA request to dredge and fill for keeping oil off-shore	5/9/2010	Bavishi
follow-up on cooperative MOU and BP science sharing, and ability for contract academic scientist to share data	5/10/2010	Schiffer, GC
Identify NOAA Scientist to serve as lead for our scientific activities and liaison for the academic community	5/10/2010	Kennedy/Glackin/ORR
Follow up with MS and AL regarding fisheries closure. NMFS has call today with State Directors	5/10/2010	NMFS
subject matter expert briefings	5/10/2010	Comms with JIC
Ensure we are adequately ramping up our capacity to analyze seafood safety issues	5/10/2010	Murawski/Thompson
Review DOS Embassy cable	5/10/2010	DWH, ORR

OMB request that NOAA serve as Federal lead for Deepwater Horizon consolidated website	5/11/2010	Sarri to follow-up with OMB, Klimavicz
Provide guidance to staff regarding tracking hours, expenses, etc in relation to this event	5/11/2010	Gallagher/all staff
NOAA SSC /RRT efforts to host workshop on dispersants, region-wide assessment, impacts, long-term fate, etc.	5/11/2010	conner
Seafood Sampling plan details for DOC	5/11/2010	NMFS
Fisheries Disaster Declaration Apparently the Governor sent a letter to Sec. Locke on April 30 seeking a disaster declaration for MS fisheries due to the leak. They have not heard anything about their request and asked for a status update.	5/11/2010	NMFS
Process for forwarding funding requests to Unified Command or other leads	5/12/2010	ORR/Gallagher
Move proposals for IOOS HFR and second flight of P-3 through approval process	5/12/2010	ORR/OAR/Gallagher
Prepare request to Mary Landry regarding NOAAs research/scientific requests, ceiling of requests, and streamlined process for making requests	5/12/2010	ORR/Gallagher
Guidance for staff on congressional town halls, local/regional meetings with congress ensure consistent messaging	5/12/2010	Gray, Bagley
Request rough estimate for number of NOAA staff in the region, distinct from those on TDY	5/13/2010	Taggart
Follow-up today for science coordination across NOAA and engagement/coordination with Navy	5/13/2010	Murawksi as lead, Zdenka,others
Request for time on aircraft for NMFS enforcement	5/13/2010	Oliver/Kenul
Follow-up regarding interview scheduled for today in Houma	5/13/2010	Kenney/Westerholm/Conner
Media protocol work through Office of Communications and External Affairs on all media requests.	5/13/2010	All staff
External constituent engagement protocol work through appropriate offices: Office of Communication and External Affairs and o Office of Legislative and Intergovernmental Affairs	5/13/2010	All staff

When you meet with external groups, please send a brief report out of the meeting and interests of the public (all)	5/13/2010	All staff
Barrier Island fill-in follow-up today, ensure Habitat Office is engaged; host call today with NOAA HQ and staff ASAP today (5/13)	5/13/2010	Yozell
Request for data on normal numbers of turtle and dolphin strandings/deaths for the longest historical data	5/13/2010	NMFS
Follow-up on flow-rate estimates	5/14/2010	Murawski and team
NOAA needs to step out in a stronger way regarding our science and examining the whole ecosystem; air quality and water quality.	5/14/2010	
Utilize Sea Grant more effectively to serve as our liaison for engaging with the community	5/14/2010	McLean, Winer, Kennedy, Murawski
Engage external scientific community to validate video's from BP	5/14/2010	Beaverson
ADML Landry request 30-day ship time, use of the Gordon Gunther	5/15/2010	Kenul/westerholm
Overview of sampling that is not being done, broad issues related to understanding where the oil is and what its impact is (all assets, not exclusive to NOAA assets) Requested to send this to the NIC	5/15/2010	Murawksi and team
Clear Daily report on status of marine mammals and turtles	5/15/2010	ORR/ICC
Create daily chart showing mortality in relation to: #of total dead turtles, # sent for necropsies, # necropsies completed, and # dead due to oil.	5/15/2010	NMFS
Assess capacity to conduct work needed request to review this and if more people are needed	5/15/2010	NMFS/ORR
develop timeline of seafood safety testing in advance of Monday Meeting/call at WH	5/15/2010	NMFS
Ensure routine updates on 0800 calls on key issues NOAA is working on	5/15/2010	Dieveney/Kennedy
Ensure clear lines of communication and updates between NOAA and NIC	5/15/2010	Dieveney/Westerholm/Miller
Reconstruct process of how NOAA has been engaged with developing/communicating release rate	5/15/2010	ORR-Seattle

Contact sheet for where to refer constituents to for key information	5/15/2010	Dieveney/Winer team
Strategies to communicate our issues, particularly NMFS closures to public	5/15/2010	Sutter/Winer
Assign lead technical expert for LA barrier island issue	5/15/2010	Yozell
Check in on monitoring plan regarding use of sub-sea dispersants	5/15/2010	Westerholm/Henry
Develop product for what our NERR and NM Sanctuary sites are seeing	5/15/2010	NOS
Follow-up on release of chemical contents of dispersants for seafood safety testing needs	5/15/2010	Kennedy/Westerholm
Identify mechanism to follow-up with attendees at community meetings	5/15/2010	McLean/Winer/Bamford/Gray
Follow-up on NOAA representation at NIC and if Mark Miller and Ralph Lopez need additional support	5/16/2010	Miller with leadership
Communication plan for loop current, ensure have same story for all constituents. Talking points for leadership	5/16/2010	Kenney
Move loop current one-pager through clearance ASAP	5/16/2010	Murawski/Dieveney/leadership clearance
Change loop current map: oil portion stippled to indicate that the oil is not uniform across the spill, show loop current as a somewhat more varied flow	5/16/2010	Haddad
Tuesday, 2-3 meeting hosted by OMB for bi-cameral Congressional meeting to review legislation that has been introduced who should participate on behalf of NOAA	5/16/2010	Gray
Formal request needed through NIC for chemical components of dispersants, assistance from GC if needed	5/16/2010	Tim Gallagher
Dispersant Monitoring plan should include efficacy of dispersant on oil, and biological/ecological impacts	5/16/2010	Tim Gallagher
Hurricane outlook interactions with oil spill talking points and Tuesday 8am briefing	5/16/2010	NWS
Develop talking points for issue of Pelican cruise and scientific statements asserted in press	5/17/2010	Kenney/McLean
Line Office assess participation in 3 technical working groups that are stood up by the Interagency Solutions group	5/17/2010	LO Leadership

Develop proposal for engaging academic community (for review today)	5/17/2010	Murawski/Sandifer/Haddad, others
Reconsider fisheries closure in light of data provided from Pelican cruise. Also conducting random dock-side sampling to ensure seafood safety.	5/17/2010	NMFS
Expedited review of Loop 101 and Talking Points internal by 0930	5/17/2010	HQ clearance
Expedited review of Long-Term Transport of Oil and Talking Points internal by 1100	5/17/2010	HQ clearance
Follow-up on research platforms that could be deployed and sampling plan from all assets	5/18/2010	Murawski/McLean
Expert briefing for Loop Current	5/18/2010	Kenney
Histogram by day for turtle strandings	5/18/2010	NMFS
Request for talking points for turtle strandings	5/18/2010	NMFS
Precautionary closure of fisheries due to potential of oil in the loop current	5/18/2010	NMFS
Assign technical point for OMB, DOC, FDA group regarding seafood safety; .	5/18/2010	NMFS
Need to have talking points and alert Cuba and Mexico regarding fishery closure and potential of oil in loop current	5/18/2010	
Alert WH of fishery closure change	5/18/2010	Sarri
Talking points on loop current, fishery closure, international, states what we are doing to address the potential that oil is in the loop current	5/18/2010	DWH Team with experts

Status	Outcome
On-going	
Completed	
Completed	
Completed	
Completed	questions from WH
Completed	
Completed	Submitted through JIC process, not a NOAA product
Completed	
Completed	
Completed	briefing to take place on 5/18
Completed	http://www.charts.noaa.gov/ENCs/?M_D
Completed	map is now created periodically showing all NOAA assets in the region
Completed	map is now created periodically showing all NOAA assets in the region
Completed	map is now created periodically showing all NOAA assets in the region
Completed	Have one-pager with info for use
Completed	one-pager developed and sent for clearance on 5/17
Completed	
Completed	being coordinated through Unified Command
On-going	External Affairs team in place to support
Completed	cleared and posted on-line
Completed	request to engage UNH through the science summit proposal and engaging academic scientists
Completed	complete and posted on-line
Completed	
Completed	
On-going	requested by GC
	working on IPA
Completed	BP not requesting
Completed	BP not requesting
Completed	5/7 version completed and available for use internally
need follow-up	what is NIST concern?

On-going	
On-going	Birnea to travel 5/10 to review situation and develop a plan
Completed	
Completed	vendor AIRINC could also serve this role
Completed	
Completed	info sent to John Rapp for use
Completed	completed, needs to be posted on-line
Completed	
OBE	
On-going	Dr. L to call google colleagues to follow up www.google.com/crisisresponse/oilspill
On-going	will be built into every days tps
Completed	Experience tells me that the response would go on for 45-60 more days, but the oil will all be beached or dispersed within about 30
	Pedro to close loop with NOAA and DOI
Completed	Need to have final Q&A
Completed	On the guidance for volunteer issue, Caren and I are working with BP's volunteer coordination program coordinators to establish a protocol for providing information to BP about organizations that have volunteer resources and organizations in the Gulf that are capable of accepting volunteers. Based on my discussions, BP should be ready to discuss these protocols by Wednesday/Thursday, and we are planning a call with BP's volunteer coordinators and the external affairs working group organized by CEQ. In addition, the Fish and Wildlife Service and NOAA are working together to take the various lists of entities offering volunteers and organizations in the Gulf seeking volunteers and create a working document. After we determine the best way to interface with BP, we will likely send the document to JIC and get approval to share it with BP.
On-going	there is a mechanism in place (LA Sea Grant), for which funds if available could always be added, other regional Sea Grants following suit. Sea Grant should be included in the suite of granting mechanisms engaged, but not be sole route
	To follow-up with Michele Finn to identify SSC or other to brief
Completed	list sent to Justin on Sat. No known outcomes from Adm Allen phone call

Completed	Determine that we could coordinate Federal participation on SCAT (as of 5/10/10: 4 out of Houma; 5 out of Mobile)
Completed	analysis shows this is from Mississippi 252; likely sourced from initial blast
completed	sent with notice of confirmation of AS Dr. Larry Robinson
Completed	Talking points cleared and delivered
	Analysis being done 5/10 by LUMCON, should have information today
Completed	activities on-going to engage scientific community across NOAA and external partners
	call taking place on 5/12 (EPA, NOAA, DOI)
completed	Gary Matlock - intra-agency; Murawski - interagency; Sandifer - academic liaison
Completed/but continued engagement needed	NMFS has call today with State Directors
On-going	Disperants, Hurricanes, Seafood Safety, etc.
Completed	NMFS text has been provided regarding fish closures and seafood safety

	contact made to DOC CFO to take action to follow-up with OMB to make a formal request of Randy Lyon, Randolph_M._Lyon@omb.eop.gov, and ask about a possible DOC leadership role perhaps through multi-agency coordination with SBA to explore further what is required for physical one-stop locations.
Completed	guidance distributed on 5/12
in progress	Charlie Henry is trying to push forward with this using BP funding. He requested that Dave Kennedy support the concept to BP while he is in Louisiana. We should also start to support the idea in NRT calls and discussions with EPA.
draft developed	Meeting with OMB, DOC, and FDA Monday, 5/17
Completed	FTEs in 5 regional states: 1400; within 20 miles of coastline: ~750
Completed	activities on-going
Completed	interview was canceled
On-going	Contact: Justin Kenney (justin.kenney@noaa.gov), Scott Smullen (Scott.smullen@noaa.gov) and Jennifer Austin (Jennifer.austin@noaa.gvo).
On-going	Office of Communication and External Affairs (Andy Winer: Andrew.winer@noaa.gov); Office of Legislative and Intergovernmental Affairs (john.gray@noaa.gov)

On-going	send to Andrew.winer@noaa.gov and dwh.staff@noaa.gov
On-going	meeting happening in region today: rachel sweeney, pat williams to participate on behalf of NMFS
outstanding	data received by NMFS on 5/17, in process
	(updated 5/14) WHOI scientists are capable of deploying instruments on one of the working ROVs. We discussed making multiple acoustic measurements to assess the degree of variability. This looks to be doable
	Regional meeting with all Sea Grant Directors scheduled for Monday, 5/17
	request for longer piece of video is still outstanding (5/17)
Completed	Identify what other NOAA/academic assets has that are comparable; o Connect with Unified Area Command to determine needs and how needs could be met by other NOAA /academic assets
	Request from WH Principals meeting on 5/14 - note that if more resources are needed we should ensure we have them
	Report for daily situation report
	Request from WH Principals meeting on 5/14; DoI requested to do same for birds
	Request from WH Principals meeting on 5/14 - note that if more resources are needed we should ensure we have them
On-going	
On-going	NOAA contacts at NIC: Mark Miller (mark.w.miller@noaa.gov); Ralph Lopez (ralph.lopez@noaa.gov)

	Has polled team for technical expert engagement (Miles Croom, Chris Doley, others)
completed	
On-going	Contact made to NERR and ONMS on 5/14 for follow-up
outstanding	NOAA NIC contacts tracking this down today 5/14
	assessing additional full-time science staff
Completed	
Completed	
Completed	
	Spring/NMFS(Reisner)/NOS (Westerholm and Kennedy)
completed	
completed	will be given to team on 5/18
Completed	
	Proposal from Mark Miller: Discharge Rate technical team potential participants: Dr. Bill Lehr, OAR (Dr. Ned Cokelet, PMEL); • Loop current team potential participants: Dr. Jerry Galt, Dr. Rich Patchen (Environmental Assessment Group has also taken this issue on); • Subsea Dispersant Characteristics potential participants: Dr. CJ Beegle-Krausen, Dr. Alan Mearns

draft submitted 5/17	
Completed	verified that the area in which the Pelican was working is within the closed area
Completed	JIC cleared (5/17) OMB/WH pending
outstanding	
	Closing larger area of fishery will be announed 1300 today, in effect 1600 today
	Steve Wilson and Tim Hansen can serve this role
completed	press briefing on loop current conducted 5/18 at 1100.

NOTES

Mussel Watch (John Christensen in NCCOS) is sampling for chemicals in shellfish along the coast to establish new base lines before oil hits and will be testing during and after spil hits shorelines. It is nation's longest continual water quality/shellfish monitoring program.
NCCOS scientists (Rick Stumpf) on what red tides/ algae they have IDed in Gulf.

no specific criteria they are using NOAAs 3 day traj's like us

Dispersants (5/12)

Document ID: 0.7.19.1728.1

Deepwater Integrated Services Team led by Tracy Wareing, DHS, and Daniel Werfel, OMB. Leon Cammen, NOAA Sea Grant,

NIST: Flow Metrology Group and the POC there is Pedro Espina (pedro.espina@nist.gov, 301-975-5444)
USCG is using contract vessel. No need for NOAA to reallocate the Gunther (reported on 5/17)

Daily briefing books	every day	McClurkin	
NRT talking points	every day	Conner	
DOC Secretary call talking poin	every day	Bavishi	
NRT action items	every day	Holst, Bavishi, Rapp	

For Official Use Only/Not for Public Release
NOAA Daily DeepWater Horizon Call
Tuesday, May 18, 2010; 0800
Telephone [redacted]

Call Guidelines:
·Place your phone on mute at all times unless you are speaking
·Do not place your phone on hold

Additional Attachments
Task list record of actions from 0800 Daily NOAA calls as of 5/18 (this is for reference only)

Action Items
·Follow-up on research platforms that could be deployed and sampling plan from all assets (Murawski and team, report in advance of afternoon testimony)
·Expert briefing for Loop Current (Kenney)
·Histogram by day for turtle strandings (NMFS)
·Request for talking points for turtle strandings (NMFS)
·Precautionary closure of fisheries due to potential of oil in the loop current (NMFS)
·Assign technical point for OMB, DOC, FDA group regarding seafood safety; Steve Wilson and Tim Hansen can serve this role.
·Need to have talking points and alert Cuba and Mexico regarding fishery closure and potential of oil in loop current (Turner)
·Alert WH of fishery closure change (Sarri)
·Talking points on loop current, fishery closure, international, states – what we are doing to address the potential that oil is in the loop current (Murawski, Mclean, Turner to send to Kenney by 10am)

Documents cleared through WH clearance process for 5/11/10
(currently, this list is incomplete but will be updated on a daily basis)

FACT SHEETS – CLEARED & POSTED ONLINE
·Booms
·Coral reefs & oil
·Marine mammals and sea turtles
·Gulf of Mexico Oil Spill General (Fish)
·Fish stocks in the Gulf of Mexico
·Seafood safety
·Impact of crude oil on seafood
·Natural Resources Damage Assessment
·Shorelines and coastal habitats in the Gulf of Mexico
·Dispersants (OR&R sheet)
·Shoreline & habitats (OR&R sheet)
·Shoreline Cleanup and Assessment Technique (SCAT) (OR&R sheet)

FACT SHEETS – IN CLEARANCE/WORK
·Sheen (cleared/not posted)
·Oil weathering/types
·Loop current
·Mussel Watch
·NOS activities
·Hypoxia (dead zone) & oil

Websites for more information:
OR&R Response Outreach – http://response.restoration.noaa.gov/deepwaterhorizon (cleared fact sheets)
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ResponseLink – https://responselink.orr.noaa.gov
NOAA ICC Sitreps - https://www.homelandsecurity.noaa.gov/icc_sitreps.html

Updates on Fisheries Closure – http://sero.nmfs.noaa.gov/
Daily updates to NOAA nautical charts: http://www.nauticalcharts.noaa.gov/.

Joint Information Center Contacts (as of 5/11/10)
David Miller / 202-329-4030 (LA)   david.p.miller@noaa.gov (through Monday, May 17th)
Monica Allen (NOAA Fisheries Communications) is there this week (5/15-20). Her cell # is 202/379-6693.
Replacement: Rachel Wilhelm arrives Sat., May 15th / 202-657-9816.

NOAA Scientific Scientist Coordination on site (as of 5/17/10)
Charlie Henry (206-849-9928) – Robert, LA
LCDR Demian Bailey (206-518-1941) - Robert, LA
Ed Levine (206-849-9941) - Houma, LA
Jordon Stout (206-321-3320) - Houma, LA
Frank Csulak (732-371-1005) - Houma, LA
Ruth Yender (206-849-9926) – Mobile, AL
LCDR Liz Jones (206-849-9918) - Mobile, AL
John Whitney (907-440-8109)- Mobile, AL
Brad Benggio (206-849-9923) - St. Petersburg, FL
LTJG Josh Slater (206-462-0710) – Mobile, AL
Mark Miller (206-713-0640) - NIC, Washington DC
Carl Jochums – NOAA contractor boom expert on site.

Received(Date): Tue, 18 May 2010 12:00:22 -0400
From: "Jainey.Bavishi" <Jainey.Bavishi@noaa.gov>
Subject: Notes from May 18, 11 AM NRT Call
To: _NOAA HQ leadership <NOAAHQ.Leadership@noaa.gov>,_HDQ Policy Contacts <Policy.Contacts@noaa.gov>,_HDQ PCO Contacts <PCO.Contacts@noaa.gov>, "Sarri, Kristen" <KSarri@doc.gov>,David Kennedy <David.Kennedy@noaa.gov>,"'dwh.staff@noaa.gov'" <dwh.staff@noaa.gov>

Below are notes from the May 18, 11 AM NRT call.

FOR OFFICIAL USE ONLY

National Response Team Call
May 18, 2010
11:00 AM

The next NRT meeting is May 19 at 11 AM.

Situation Status:
-Riser insertion tool is capturing about 2,000 barrels/day and has been successful for the past 24 hours. A second tool is in place in case first tool fails.
-Window of opportunity for top kill is between now and May 25. The window of opportunity is dependent on pressure and temperatures. Still trying to get a better handle on associate risks.
-Third option for release control is stacking a second BOP.
-Four burns were conducted yesterday. The good weather window continues to continue surface operations with more burns and aerial dispersant application today.
-Subsurface dispersant injection is pending until monitoring vessel is on scene.
-Great deal of reporting on undersea plume and interaction with loop current --- need more focused messaging to explain what is happening subsurface and what happens to oil in loop current.
-Analysis of tarballs is being expedited.
-Interactions with Cuba and Caribbean are being initiated through Dept. of State.
-Proactive messaging today will be focused on managing impacts in Florida and a confident and agreed upon position on subsurface plume. Story tomorrow will be about Cuba.
-DHS offered to help to make sure NOAA has all of the aerial capabilities it needs.

Communications:
-Multiple people testifying today.
-Proactively analyzing tarballs and communicating that information (we expect results from tarballs found in Keys in 12 hours).
-Dr. Lubchenco is on media call to address the loop current --- significant news coverage today that oil is in loop current.
-FWS will hold a press call later today on impacts on turtles and other wildlife.

Legal:
-Briefing on Hill on current legislative proposal which will include proposed changes to Oil Spill

Liability Trust Fund.

<u>Intergovernmental</u>:
-Email going out to all 50 states with information on loop current.
-Plan to also address loop current issue on the county/local call later today.

<u>Congressional Affairs</u>:
-Getting ready for hearings today and tomorrow.
-Coordinated plan needed for CODEL visits.

<u>Dredging Proposal</u>:
-Army Corps is playing out permitting process for viability of berm project --- this does not ensure funding or follow on of project implementation.
-While process is playing out, Gov. Jindal is talking to the press about the high likelihood of the project being approved.
-BP does not consider this project a response cost.
-NIC also believes that this is not an appropriate response mechanism.

Received(Date): Tue, 18 May 2010 13:14:31 -0400
From: Andrew Winer <Andrew.Winer@noaa.gov>
Subject: NGO Letter to President
To: "noaahq.leadership@noaa.gov" <NOAAHQ.Leadership@noaa.gov>,"dwh.staff@noaa.gov" <dwh.staff@noaa.gov>

FYI.

From: Jeremy Symons [mailto:Symons@nwf.org]
Sent: Tuesday, May 18, 2010 1:04 PM
To: Salzman, Amelia S.; Stanislaus.Mathy@epamail.epa.gov; Nelson, Gregory S.; Zichal, Heather R.
Subject: Heads Up: Letter to the President

I want to give you a heads up that a letter is being finalized in the next 24 hours to the President requesting that the federal government take over all environmental, wildlife and safety testing and monitoring from BP, that all testing and monitoring information be disclosed to the public, and that the federal government ensure appropriate safety measures for fishermen volunteers.

Also, you are probably aware that fishermen in Louisiana held a press conference yesterday calling for halting the use of dispersants. They feel the dispersants are unsafe and that they aren't being protected with appropriate gear. We didn't have a role in yesterday's event, but we listen closely to these local responders, and we are concerned that insufficient public information has been provided to gauge the safety and impacts of these chemicals and dispersed oil.

In short, we recognize that these are tough no win decisions, but we believe the data that is informing the decisions needs to be shared with everyone. The fact that the responsible party, BP, is in the middle of these decisions and monitoring the damage from their spill at this stage simply heightens the need for transparency.

Thanks,

Jeremy

Jeremy Symons
Senior Vice President, Conservation and Education
National Wildlife Federation

Mobile: (202) 306 7902
Email: symons@nwf.org

Twitter: @JeremySymons

National Wildlife Federation inspires Americans to protect wildlife for our children's future.

Received(Date): Tue, 18 May 2010 18:39:58 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: FW: Pre-brief at 9:05 on Wed.
To: dwh.staff@noaa.gov, 'Monica Medina' <Monica.Medina@noaa.gov>,John.Gray@noaa.gov, David.Kennedy@noaa.gov, Dave.Westerholm@noaa.gov,'Adele Stevens' <Adele.Stevens@noaa.gov>, Jen.Pizza@noaa.gov

Here is the information for tomorrow's Governor's call and pre-brief.

From: McGrath, Shaun L. [mailto:Shaun L. McGrath@who.eop.gov]
Sent: Tuesday, May 18, 2010 1:45 PM
To: McGrath, Shaun L.; Belton, Linda; Monica Medina; heather.smith1@dhs.gov; Tennyson, Stephanie L; Pallone.Sarah@epamail.epa.gov; Lori Faeth; Kayyem, Juliette; Murk, David CDR
Subject: Pre brief at 9:05 on Wed.

All,

Draft agenda for the call tomorrow is below. Please let me know if there are any changes.

Wednesday, May 19 Call with Governors

9:05 a.m. pre-brief; 9:15 Governors

[redacted]

[redacted] – **Speakers**

Please limit participation in the pre-conference to speakers and essential staff.

<u>DRAFT AGENDA</u>

· Opening remarks (Valerie Jarrett)

· Observations and Trajectory – **Monica Medina, NOAA**

o NOAA will provide the latest observations and trajectories

o Loop Current

o Jindal – questioned the accuracy of the trajectories – he noted that there was significantly more oil along the shoreline than what had been projected.

o Jindal – did the burning, skimming and surface dispersants application get factored into to today's trajectory?

· Situation and Leak Stabilization Update – **Adm Mary Landry**

o Latest information from National Incident Command, including current status of efforts to stabilize the leaks.

· Operations Report – **Adm Mary Landry**

o Response Plans and Boom

o Jindal – what is the report from the SCAT teams?

o Watson – Do not yet have the estimates of oil burned, skimmed and dispersed from yesterday. Can we get estimate of both days for tomorrow?

o Watson – did not yet have the tests back from the crab pot dip stick testing of the subsurface oil.

o Jindal – asked whether the tarballs recovered from Marsh Is. in Iberia have been tested yet to see whether they are from the BP spill? (no) If it is related, it would be the furthest west that the oil has travelled.

o Jindal – Monica mentioned that oil has moved passed booms and gotten into the marshes. What are the reasons for the oil getting past the boom? Failed boom; too much oil; subsea oil; improperly placed boom? David Kennedy did not know the answer in this case, but said boom is never a fail-safe solution.

o Jindal – wants more boom moved to the West (although he acknowledged the 1000 new feet that arrived in Terrebonne

o Jindal – said he met with Col Lee of USACE yesterday to discuss barrier proposal. Col Lee was positive about the comments received on the proposal; and the Governor said that Adm. Landry has been supportive of the proposal. He urged us to expedite the barrier.

· Wildlife Impacts – **Eileen Sobeck, FWS**

o Wildlife crews were not able to get out much over the weekend. They should be able to get out in the coming days. Action: continued update on their findings.

· Marine Wildlife Impacts and Fisheries Closures – **Monica Medina, NOAA**

o Monica – NOAA seeing increased turtle strandings. Looking to see if there is a pattern that is related to the oil.

o Monica – NOAA expanded fisheries closure yesterday. NOAA is watching the loop current issue closely. If oil moves into the loop current, there will likely be a large expansion of closed fisheries.

· EPA Update – **EPA Dep Admin Bob Perciasepe**

· Open discussion and Q&A with Governors and state officials

· Next call – 9:15 a.m. EDT (8:15 CDT) Thursday, May 20, 2010

-

Received(Date): Tue, 18 May 2010 18:50:09 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: FW: 5/18/2010 Local Government Call Report
To: dwh.staff@noaa.gov, John.Gray@noaa.gov

Here are the notes from the local officials call at 3:00pm today

Conference Call with Local Government Officials

Tuesday, May 18, 2010

3:00PM (EST)

Total Callers: 29 (includes moderators and conferees)

BRIEFING:

Coast Guard Captain James Hanzalik

- Riser insertion tube into the riser – gathering 2,000 barrels per day
- Subsea dispersant activity continuing into this morning – 8 million gallons
- 4 Controlled burns yesterday and today was a good burn day as well – reports can be expected tomorrow
- Boom update for Gulf States

Charlie Henry, NOAA

- Expectations on loop current and slick:

o Bulk of oil is north of current

o Limited amount of oil susceptible to the current

o Reviewing transport pattern, looking at 10 or more days

QUESTIONS/COMMENTS:

Michele Tassin, Emergency Operations Center Director, Plaquemines Parish

· Question: Is satellite imagery available online?

o Lori Faeth Answer: Good information is available at www.deepwaterhorizonresponse.com

o Dan Dealy, Mobile, Alabama, Answer: www.skytruth.org also has useful information

Dan Dealy, Mobile, Alabama

· Question: Do you have a further update on the research being conducted on underwater plumes?

o Charlie Henry Answer: Samples are not accurate due to the way the droplets disperse. Larger droplets rise quickly to the surface while the smaller droplets stay below. NOAA does not view underwater plumes as a significant threat at this time and is working to get a better projection on deep water currents to determine short and long-term implications. This analysis will be forthcoming in the days ahead. With regard to concerns that subsea dispersants are correlated to underwater plume, NOAA does not see a correlation. At the time of the inquiry, there were only a few days of subsea dispersant activity, so NOAA does not think subsea dispersant was a significant driver.

Bill Melton, Environmental Services Director, Mobile County Public Works

· Question: Following up on yesterday's question on economic impact loss for impacted areas.

o Captain Hanzalik: Also will make sure that commerce is on the phone to answer the question tomorrow.

o Jane, SBA: Working on declarations for small business loans

o Heather Smith, DHS: This info is available on www.deepwaterhorizonresponse.com

o Nandi Chhabra, WH: We will follow up with Melton individually, and also on the call tomorrow.

Received(Date): Wed, 19 May 2010 00:36:38 -0400
From: Jen.Pizza@noaa.gov
Subject: 5.18.2010 noaa leadership meeting notes - recap.
To: Jane.Lubchenco@noaa.gov,"'Larry.Robinson1@noaa.gov'" <Larry.Robinson1@noaa.gov>,"'margaret.spring@noaa.gov'" <Margaret.Spring@noaa.gov>,Mary.Glackin@noaa.gov,"'dave.westerholm@noaa.gov'" <Dave.Westerholm@noaa.gov>,"'David.Kennedy@noaa.gov'" <David.Kennedy@noaa.gov>,Robert Haddad <Robert.Haddad@noaa.gov>, Monica.Medina@noaa.gov,dwh.staff@noaa.gov, Sally.Yozell@noaa.gov, Dave.Westerholm@noaa.gov,James.Turner@noaa.gov, Lois.Schiffer@noaa.gov, John.Gray@noaa.gov,Justin.kenney@noaa.gov, Linda.Belton@noaa.gov, ksarri@doc.gov,Kent.Laborde@noaa.gov
DWH NOAA DAILY MEETINGRECAP_5.18.2010.docx

good evening everyone,
attached is a compilation of notes from noaa leadership meetings on tuesday, may 18, 2010.
let me know if there are any modifications necessary.
best,
jen

SUMMARY OF NOAA LEADERSHIP DAILY DEEPWATER HORIZON 8 AM BRIEFING
TUESDAY, MAY 18, 2010
Call Guidelines:
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·Do not place your phone on hold

Additional Attachments
Task list record of actions from 0800 Daily NOAA calls as of 5/18 (this is for reference only)

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·Assign technical point for OMB, DOC, FDA group regarding seafood safety; Steve Wilson and Tim Hansen can serve this role.
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·Alert WH of fishery closure change (Sarri)
·Talking points on loop current, fishery closure, international, states – what we are doing to address the potential that oil is in the loop current (Murawski, Mclean, Turner to send to Kenney by 10am)

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·Fish stocks in the Gulf of Mexico ·Seafood safety
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·Dispersants (OR&R sheet)
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·Oil weathering/types
·Loop current
·Mussel Watch·NOS activities
·Hypoxia (dead zone) & oil

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Monica Allen (NOAA Fisheries Communications) is there this week (5/15-20). Her cell # is 202/379-6693.
Replacement: Rachel Wilhelm arrives Sat., May 15th / 202-657-9816.NOAA Scientific Scientist
Coordination on site (as of 5/17/10) Charlie Henry (206-849-9928) – Robert, LA
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Ed Levine (206-849-9941) - Houma, LA
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Carl Jochums – NOAA contractor boom expert on site.

SUMMARY OF DAILY CALLS WITH THE GOVERNORS: DEEPWATER HORIZON UPDATE MEETING: TUESDAY, MAY 18, 2010, Moderator: Valerie Jarrett
Governors: Jindal
· EPA – applying subsea dispersant (when monitoring ship is in place). Will switch dispersants today based on toxicity. (Action: provide info on new dispersants and reasons)
· Gov. Jindal – questioned the accuracy of the trajectories – he noted that there was significantly more oil along the shoreline than what had been projected. Why is that? Monica · Gov. Jindal – did the burning, skimming and surface dispersants application get factored into to today's trajectory? (NOAA response for tomorrow) · Gov. Jindal – asked about reports from the SCAT teams
· Adm. Watson – Do not yet have the estimates of oil burned, skimmed and dispersed from yesterday. Will continue those operations today. Can we get estimate of both days for tomorrow?
· Adm. Watson – did not yet have the tests back from the crab pot dip stick testing of the subsurface oil.
· Gov. Jindal – have the tarballs recovered from Marsh Is. in Iberia get tested yet to see whether they are from the BP spill? (no) If it is related, it would be the furthest west that the oil has travelled.
· Eileen Sobeck (FWS) – wildlife teams out yesterday and again today. (Report on wildlife impacts tomorrow?)
· Monica Medina – NOAA seeing increased turtle strandings. Looking to see if there is a pattern that is related to the oil.
· Fish closures - NOAA expanded fisheries closure yesterday; watching the loop current issue closely. If oil moves into the loop current, there will likely be a large expansion of closed fisheries. (NOAA wants to maintain the safety and confidence in the seafood industry.)
· Gov. Jindal – Monica mentioned that oil has moved passed booms and gotten into the marshes. What are the reasons for the oil getting past the boom? Failed boom; too much oil; subsea oil; improperly placed boom? David Kennedy did not know the answer in this case, but said boom is never a fail-safe solution.
· Gov. Jindal – wants more boom moved to the West (although he acknowledged the 1000 new feet that arrived in Terrebonne

· Gov Jindal – said he met with Col Lee of USACE yesterday to discuss barrier proposal. Col Lee was positive about the comments received on the proposal; and the Governor said that Adm. Landry has been supportive of the proposal. He urged us to expedite the barrier. Do we need to manage expectations?

SUMMARY OF NATIONAL RESPONSE TEAM CALL TUESDAY, MAY 18, 2010

Situation Status:

-Riser insertion tool is capturing about 2,000 barrels/day and has been successful for the past 24 hours. A second tool is in place in case first tool fails.
-Window of opportunity for top kill is between now and May 25. The window of opportunity is dependent on pressure and temperatures. Still trying to get a better handle on associate risks.
-Third option for release control is stacking a second BOP.
-Four burns were conducted yesterday. The good weather window continues to continue surface operations with more burns and aerial dispersant application today.
-Subsurface dispersant injection is pending until monitoring vessel is on scene.
-Great deal of reporting on undersea plume and interaction with loop current --- need more focused messaging to explain what is happening subsurface and what happens to oil in loop current.
-Analysis of tarballs is being expedited.
-Interactions with Cuba and Caribbean are being initiated through Dept. of State.
-Proactive messaging today will be focused on managing impacts in Florida and a confident and agreed upon position on subsurface plume. Story tomorrow will be about Cuba.
-DHS offered to help to make sure NOAA has all of the aerial capabilities it needs.

Communications:

-Multiple people testifying today.
-Proactively analyzing tarballs and communicating that information (we expect results from tarballs found in Keys in 12 hours).
-Dr. Lubchenco is on media call to address the loop current --- significant news coverage today that oil is in loop current.
-FWS will hold a press call later today on impacts on turtles and other wildlife.

Legal:

-Briefing on Hill on current legislative proposal which will include proposed changes to Oil Spill Liability Trust Fund.

Intergovernmental:

-Email going out to all 50 states with information on loop current.
-Plan to also address loop current issue on the county/local call later today.

Congressional Affairs:

-Getting ready for hearings today and tomorrow.
-Coordinated plan needed for CODEL visits.

Dredging Proposal:

-Army Corps is playing out permitting process for viability of berm project --- this does not ensure funding or follow on of project implementation.
-While process is playing out, Gov. Jindal is talking to the press about the high likelihood of the project being approved.
-BP does not consider this project a response cost.
-NIC also believes that this is not an appropriate response mechanism.SUMMARY OF DOC-NOAA DEEPWATER HORIZON UPDATE MEETING: TUESDAY MAY 18, 2010,

ACTIONS:

· Dispersant Workshop planning
· Hurricane/oil talking points, briefing at tomorrow's meeting
· Strategies to respond to the many requests for NOAA leadership to be at meetings in the Gulf
· 530 pm meeting is on for today.

MEETING MINUTES: DISPERSANT ISSUES

· Planning by RRT/NOAA is underway for a Dispersant Workshop, to discuss the long term impacts of applying dispersant. Intent is to have this soon, within a few days. This would include not only government but also representatives from academia.
· Discussion about the long term costs and personnel needs for testing and monitoring. NOAA is developing a plan.
· Use of subsurface dispersant is much more effective than using dispersants on the surface oil.
FISHING CLOSURES
· 30-day closure rule will allow NOAA to amend closures simply by updating the maps online, instead of having to go through formal approval processes. OMB is examining this at the moment. This would be analogous to the online trajectory maps.
· No press release would be broadcast with each closure update; just the maps. ·Discussions are ongoing with FDA and NOAA on the closures relating to health impacts.
HURRICANES & OIL SPILL
· OMB has approved talking points developed in NOAA for how hurricanes would affect and be affected by the oil spill. · Concern was raised about evacuating the thousands of people involved in the cleanup should a hurricane move into the spill area.
· Ahsha Tribble and Chris Smallcomb will brief the group tomorrow/1030am on the Hurricane Seasonal Outlook Press Conference that Dr. Lubchenco will participate in next week.

COMMUNICATIONS & OUTREACH
· Many requests for NOAA leadership to be at meetings in the Gulf region, both technical and political people.
· Proposal to have at least one political in the Gulf region each week. Another strategy would be to use leadership from other DOC bureaus.
· Bilingual capabilities are important for some of these meetings, where fishermen speak other languages (e.g. Vietnamese)
· Discussion about an interactive, multi-agency website providing resources and information for those impacted by the oil spill. This would be a major undertaking. · A few challenges described keeping coordinated with White House on talking points and press releases.

SUMMARY OF CONGRESSIONAL STAFF CONFERENCE CALL ON THE GULF OF MEXICO OIL SPILL Facilitator
Chani Wiggins, Asst. Sec. of Legislative Affairs, U.S. Department of Homeland Security (DHS)
Speakers/Agency Representatives Included:
Rear Adm. Cook, USCG Director of Prevention Policy
Walter Cruickshank, MMS Deputy Director
Doug Helton, NOAA OR&R Incident Operations Coordinator
Roy Crabtree, NMFS Regional Administrator, SE Region
Greg Siekaniec, Chief, National Wildlife Refuge System, US F&W Service

Congressional Participants Included (Not all participants were announced)
Staff with House Energy and Commerce Committee
Staff with House Science and Technology Committee
Staff with Senate Homeland Security and Governmental Affairs Committee
Staff for Rep. Gus Bilirakis (R-9th, FL)
Staff for Rep. Kendrick Meek (D-17th, FL)
Staff for Rep. Bill Cassidy (R-6th, LA)

Remarks from Rear Admiral Cook
- The riser insertion tool has effectively relieved some pressure on the well head and the tool is assisting in the recovery of approximately 2,000 barrels of oil per day - There have been no changes to oil expressions on the surface as a result of using the riser
8,000 gal. of subsurface dispersants have been applied in the last 24 hrs.
- Dispersant application is currently on hold; we are waiting for a vessel to arrive on site to monitor dispersant application.
- Overall dispersants applied: 588,000 gal on the surface 50,000 gal subsurface

- 1.7 million feet of boom have been deployed overall
- 4 in-situ burns occurred yesterday - 20 tarballs washed ashore in Key West, FL yesterday. Samples of these balls were sent off for processing to determine if their chemical signature matches that of oil in the Deepwater Horizon spill. Results should be received in the next day or two.
- Tarballs have also been recovered in Pascagoula, MS and at other locations in the Delta region
- Tarballs are easier to recover from shore, but if they are suspended in the water column, there is the potential for them to bypass booms- 36 wildlife impacts reported thus far
- Tally of responders associated with spill has increased to 20,000 people and 1,000 vessels - Over 15,000 total claims filed to date, BP has approved all claims submitted to date and almost 400 people at work performing claims processing

Remarks from Walter Cruickshank
- Reiterated the effectiveness of the insertion tool, recovering on average 2,000 barrels of oil per day
- Recovery is a mix of oil and natural gas
- We are recovering an increasing in amount of natural gas
- We are continuing preparations for the top kill
- The pod is being reset and the remainder of the necessary equipment should be in place by weekend. We should be able to begin operations early next week.
- Relief well drilling is moving forward, 85,000 ft total depth of well thus far

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- The newest 72-hr trajectory indicates that the plume continues to move west to southwest from the source.
- We note that the oil sheen is moving toward the edge of the loop current; right now oil appears to have entered a loop current boundary gyre.
- We cannot confirm whether or not the oil plume is entrained in the loop current itself at this point. Aircraft flyovers scheduled in the next few days should help inform this effort.
- Oil impacts on shore have been noted in the Delta region, and approximately 2 km of oiled marshes have been observed. The Shoreline Cleanup Assessment Team has been deployed.

Remarks from Roy Crabtree
- As of 6:00pm today, NOAA Fisheries is expanding the eastern and southern boundaries of the closure to encompass the reported actual location and projected path of the oil based on initialization data and the 72-hour trajectory to incorporate full extent of trajectory and to address the possibility of oil entry into the loop current. - The closure measures 45,728 sq mi (118,435 sq km), which is approximately double the closure area that was previously in effect. - The majority of the expansion area is approximately 150 mi offshore, meaning that the pelagic longline fishery (which includes swordfish and tuna fisheries) is likely the fishery most affected by this change.
Remarks from Greg Siekaniec
- Fish and Wildlife Service has continued response activities and monitoring surveys.
- We continue to collect reports of affected sea turtles and other wildlife through our hotline.
- Oil has thus far been observed on 4 National Wildlife Refuges.

Questions Raised by Congressional Members and Staff
How many gallons of dispersant has been released to date? How large is the stream of oil near the loop current? What does the oil in the relief tube look like? Does the volume of flow in relief tube give any indication of overall flow leakage rate? Can you use flow rate from relief tube to estimate flow rate out of riser? Dr. Lubchenco mentioned in an earlier public/press statement that NOAA has been working right from the start on this spill, but needs more assets. What assets was she referring to? Getbacks for NOAA
- Provide context and more information regarding the assets NOAA needs that Dr. Lubchenco referred to in her earlier statement. (OLA to coordinate with NOAA Communications on where this statement may have come up and what was said)

SUMMARY OF DOC-NOAA DEEPWATER HORIZON UPDATE MEETING: TUESDAY, MAY 18, 2010,
ACTIONS: · Need to determine the chemical composition of the dispersants so that we can definitively know what we are testing for.

· Need to determine what is the “tipping point” for calling a fisheries disaster. This should include implications and public perception ramifications.
· NOAA needs to ensure that there are adequate resources to analyze the plume to properly define the characteristics (where is it, where is it going, extent, depth, etc.)
· DOC and NOAA need to establish a protocol for expanding fisheries closures that includes notification of OMB, preparing talking points, but is still responsive enough to stay ahead of the spill. If the reporting deadline is noon, then the protocol has to allow for posting then. A 24-hour lag is not responsive enough and is not acceptable. · NOAA should post maps of where fisheries sampling is taking place.
UPDATES:
· ADM Allen will not back the Louisiana governor’s proposal. BP has also determined that this is not an appropriate response mechanism, so will not fund it.
· A meeting is being held next week, hosted by the new NOAA assistant secretary to address concerns from civilian scientists who feel left out of the spill reaction.

SCHEDULING NOTES:
· The group will meet tomorrow at 5 p.m

DHS SENIOR LEADERSHIP BRIEF: DEEPWATER HORIZON RESPONSE GULF OF MEXICO 1200 EDT 18 MAY 2010
UPDATES IN BOLD BLUE

SECRETARY OF HOMELAND SECURITY PRIORITIES
· Ensure Responsible Party (RP) is doing everything it can to stop the oil leak.
· Ensure all capabilities (government, private, and commercial) and resources are being leveraged to protect the environment and facilitate a rapid, robust cleanup effort.
· Ensure every effort is being made to include and inform the local communities in support of response operations. CURRENT SITUATION
· OIL STOPPAGE
O RISER INSERTION TUBE TOOL (RITT)
· RITT remains inserted into riser. (USCG)
· Drill Rig ENTERPRISE continuing recovery of an oil and gas mixture with no water. (USCG) · Recovery rate is estimated at 2,000 barrels per day. (USCG/UAC)
· RITT-2 is being constructed and will be ready for deployment to the sea floor on 19 May. (NICC)
o RITT-2 will be used if current RITT fails.(NICC)
O TOP HAT CONTAINMENT SYSTEM
· Top Hat remains on the seabed; standing-by pending effectiveness of the RITT. (USCG)
O TOP KILL · Top Kill equipment being staged; commencement of operation no sooner than 23-25 May. (USCG)
· Commencement pushed back due to ongoing preparations.
O RELIEF WELL
· Drill Rig DDII drilling operations scheduled to resume 18 May; current drill depth is 253 ft below the sea floor. (USCG)
· Drill Rig DDIII drilling operations scheduled to resume 18 May; current drill depth remains 3,537 ft below sea floor. (USCG)
O BLOW OUT PREVENTER (BOP)
· Performing maintenance to BOP stack 18 May. (USCG) · OIL LANDFALL
o Unconfirmed reports of oil and tar balls at the following locations: East Dauphin Island, AL; Little Lagoon, AL; Fort Zachary State Park, Key West, FL; Panama City Beach, FL; Grand Isle, LA; Biloxi, MS; East Ship Island, MS; Long Beach, MS; Pascagoula, MS; and West Ship Island, MS. (USCG)

· SHIPPING CHANNELS/PORTS
o All shipping channels and ports remain open in the Gulf Coast Region. (USCG)
· No vessels have required cleaning or decontamination. (USCG)· OPERATIONS
o Oily water mixture recovered to date: 182,251 barrels. (USCG)
o Booming operations continue, weather permitting. (USCG)

· DISPERSANTS

- 3 surface dispersant sorties completed 17 May. (USCG)

· ASSETS ON SCENE: o Personnel: 20,281 (USCG/UAC)
- Boom deployed: 1,782,900 ft (1,364,510 ft regular /418,390 ft sorbent) (USCG)
- Dispersants deployed to date: 641,639 gallons (588,490 gallons surface/53,149 gallons subsea) (USCG)
- Total Vessels Assigned: 1013* (USCG/NIC)
- Remotely Operated Vehicles: 12* (USCG)
- Fixed-wing Aircraft: 17* (USCG/NIC)
- Helicopters: 26* (USCG/NIC)

*Number does not include staged or ordered assets.

AUTHORITIES
- Homeland Security Presidential Directive – 5 (HSPD – 5).
- Oil Pollution Act of 1990 (OPA 90).
- National Response Framework (NRF).
- National Oil and Hazardous Substances Pollution Contingency Plan - 40 CFR 300.300.

KEY SENIOR LEADERSHIP
- Principal Federal Official: Secretary Napolitano, U.S. Department of Homeland Security.
- Secretary Salazar: U.S. Department of the Interior. · Director Birnbaum: U.S. Minerals Management Service (MMS).
- Administrator Jackson: U.S. Environmental Protection Agency.
- National Incident Commander: Admiral Allen, Commandant, USCG.
- Federal On-Scene Coordinator (FOSC): Rear Admiral Landry, Commander, USCG, District 8, New Orleans, LA. · Responsible Party: British Petroleum (BP) and Transocean.FEDERAL AGENCIES/DEPARTMENTS
- U.S. Coast Guard (USCG)
  - Shoreline Cleanup and Assessment Teams (SCAT) are sampling oil and tar balls; clean up action being taken by BPs oil spill recovery organization. · CUSTOMS AND BORDER PROTECTION (CBP)
  - OAM continues to provide 2 aircraft to provide advisory information to spotter and tanker aircraft conducting spray operations.

- FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)
  - Region IV at Level IV operations (Steady-State).
  - Has not received any requests for Federal assistance.

- TRANSPORTATION SECURITY ADMINISTRATION (TSA)
  - TSA continues to monitor the situation for any potential impact to transportation.

- DEPARTMENT OF AGRICULTURE (USDA)
  - Animal and Plant Health Inspection Service supporting wildlife activities in LA. · DEPARTMENT OF DEFENSE (DOD)
  - 2 Vessel Skimming Systems being shipped from AK; ETA 22 May. o 3 civilian offshore support vessels (OSV), OVS WES BORDELON, OSV JOHN COGHILL, and OSV VANGUARD have been contracted by DoD.
  - 1,632 associated personnel deployed in support of spill response.
  - 100 Title 10 personnel and 1,441 Title 32 National Guard members deployed. · ENVIRONMENTAL PROTECTION AGENCY (EPA)
  - USCG and EPA authorized BP to use subsea dispersants. o Continuing monitoring and sampling of air, water and sediment.· HEALTH AND HUMAN SERVICES (HHS)
  - National Institute for Occupational Safety and Health (NIOSH) established plans to visit BP worker training staging areas in AL, FL, LA and MS.
  - Agency for Toxic Substance Disease Registry provided a draft document entitled Dispersants & Safety in Seafood to the Food and Drug Administration for review.

- DEPARTMENT OF THE INTERIOR (DOI)

o MMS reports some success is being achieved through the use of the RITT and that a larger tool is being constructed to siphon oil from the leaking riser.

· NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
o Weather forecast: · Tuesday, 18 May: West winds 5-10 knots; seas 2 ft or less.
· Wednesday, 19 May: Northeast winds 5-10 knots (am)/southeast winds 5-10 knots (pm); seas 2 ft or less. · Thursday, 20 May: Southeast winds 5-10 knots; seas 2-3 ft. CRITICAL INFRASTRUCTURE KEY RESOURCES (CIKR)
· National Infrastructure Coordinating Center (NICC)
o Revisions to the Federal closure in the exclusive economic zone allowed reopening of some oyster harvesting areas in Terrebonne Parish, LA. STATE AND LOCAL AGENCIES · Louisiana, Mississippi, Alabama, Texas, and Florida communicating daily with DHS. NATIONAL OPERATIONS CENTER
· Current Posture: Phase 2 – Concern; Crisis Action Team activated.
The next SLB is scheduled for 1800 EDT 18 May

SUMMARY:
TELECON WITH LOCAL OFFICIALS

BRIEFING:
Coast Guard Captain James Hanzalik

Riser insertion tube into the riser - gathering 2,000 barrels per day.

Controlled burns yesterday and today was a good burn day as well - reports can be expected tomorrow.
Boom update for Gulf States
Charlie Henry, NOAA
Expectations on loop current and slick:

o Bulk of oil is north of currento Limited amount of oil susceptible to the current
o Reviewing transport pattern, looking at 10 or more days

QUESTIONS/COMMENTS:
Michele Tassin, Emergency Operations Center Director, Plaquemines Parish
. Question: Is satellite imagery available online?
o Lori Faeth Answer: Good information is available at
www.deepwaterhorizonresponse.com

o Dan Dealy, Mobile, Alabama, Answer: www.skytruth.org
8e&URL=http%3a%2f%2fwww.skytruth.org> also has useful information Dan Dealy, Mobile, Alabama Question: Do you have a further update on the research being conducted on underwater plumes?
o Charlie Henry Answer: Samples are not accurate due to the way the droplets disperse. Larger droplets rise quickly to the surface while the smaller droplets stay below. NOAA does not view underwater plumes as a significant threat at this time and is working to get a better projection on deep water currents to determine short and long-term implications. This analysis will be forthcoming in the days ahead. With regard to concerns that subsea dispersants are correlated to underwater plume, NOAA does not see a correlation. At the time of the inquiry, there were only a few days of subsea dispersant activity, so NOAA does not think subsea dispersant was a significant driver.

Bill Melton, Environmental Services Director, Mobile County Public Works

Question: Following up on yesterday's question on economic impact loss for impacted areas. o Captain Hanzalik: Also will make sure that commerce is on the phone to answer the question tomorrow.

o Jane, SBA: Working on declarations for small business loans

o Heather Smith, DHS: This info is available on

www.deepwaterhorizonresponse.com o Nandi Chhabra, WH: We will follow up with Melton individually, and also on the call tomorrow.

SUMMARY OF NOAA LEADERSHIP DAILY DEEPWATER HORIZON 8 AM BRIEFING TUESDAY, MAY 18, 2010

Call Guidelines:
•Place your phone on mute at all times unless you are speaking
•Do not place your phone on hold

Additional Attachments
Task list record of actions from 0800 Daily NOAA calls as of 5/18 (this is for reference only)

Action Items
•Follow-up on research platforms that could be deployed and sampling plan from all assets (Murawski and team, report in advance of afternoon testimony)
•Expert briefing for Loop Current (Kenney)
•Histogram by day for turtle strandings (NMFS)
•Request for talking points for turtle strandings (NMFS)
•Precautionary closure of fisheries due to potential of oil in the loop current (NMFS)
•Assign technical point for OMB, DOC, FDA group regarding seafood safety; Steve Wilson and Tim Hansen can serve this role.
•Need to have talking points and alert Cuba and Mexico regarding fishery closure and potential of oil in loop current (Turner)
•Alert WH of fishery closure change (Sarri)
•Talking points on loop current, fishery closure, international, states what we are doing to address the potential that oil is in the loop current (Murawski, Mclean, Turner to send to Kenney by 10am)

Documents cleared through WH clearance process for 5/11/10
(currently, this list is incomplete but will be updated on a daily basis)

FACT SHEETS CLEARED & POSTED ONLINE
•Booms
•Coral reefs & oil
•Marine mammals and sea turtles
•Gulf of Mexico Oil Spill General (Fish)
•Fish stocks in the Gulf of Mexico
•Seafood safety
•Impact of crude oil on seafood
•Natural Resources Damage Assessment
•Shorelines and coastal habitats in the Gulf of Mexico
•Dispersants (OR&R sheet)
•Shoreline & habitats (OR&R sheet)
•Shoreline Cleanup and Assessment Technique (SCAT) (OR&R sheet)

FACT SHEETS IN CLEARANCE/WORK
•Sheen (cleared/not posted)
•Oil weathering/types
•Loop current
•Mussel Watch

•NOS activities
•Hypoxia (dead zone) & oil

Websites for more information:
OR&R Response Outreach http://response.restoration.noaa.gov/deepwaterhorizon (cleared fact sheets)
Deepwater Horizon JIC www.deepwaterhorizonresponse.com (cleared factsheets)
ResponseLink https://responselink.orr.noaa.gov
NOAA ICC Sitreps - https://www.homelandsecurity.noaa.gov/icc_sitreps.html
Updates on Fisheries Closure http://sero.nmfs.noaa.gov/
Daily updates to NOAA nautical charts: http://www.nauticalcharts.noaa.gov/.

Joint Information Center Contacts (as of 5/11/10)
David Miller / 202-329-4030 (LA) david.p.miller@noaa.gov (through Monday, May 17th)
Monica Allen (NOAA Fisheries Communications) is there this week (5/15-20). Her cell # is 202/379-6693.
Replacement: Rachel Wilhelm arrives Sat., May 15th / 202-657-9816.

NOAA Scientific Scientist Coordination on site (as of 5/17/10)
Charlie Henry (206-849-9928) Robert, LA
LCDR Demian Bailey (206-518-1941) - Robert, LA
Ed Levine (206-849-9941) - Houma, LA
Jordon Stout (206-321-3320) - Houma, LA
Frank Csulak (732-371-1005) - Houma, LA
Ruth Yender (206-849-9926) Mobile, AL
LCDR Liz Jones (206-849-9918) - Mobile, AL
John Whitney (907-440-8109)- Mobile, AL
Brad Benggio (206-849-9923) - St. Petersburg, FL
LTJG Josh Slater (206-462-0710) Mobile, AL
Mark Miller (206-713-0640) - NIC, Washington DC
Carl Jochums NOAA contractor boom expert on site.

<u>SUMMARY OF DAILY CALLS WITH THE GOVERNORS:DEEPWATER HORIZON UPDATE MEETING: TUESDAY, MAY 18, 2010,</u>

Moderator: Valerie Jarrett
Governors: Jindal

- EPA applying subsea dispersant (when monitoring ship is in place). Will switch dispersants today based on toxicity. (Action: provide info on new dispersants and reasons)
- Gov. Jindal questioned the accuracy of the trajectories he noted that there was significantly more oil along the shoreline than what had been projected. Why is that? Monica
- Gov. Jindal did the burning, skimming and surface dispersants application get factored into to today's trajectory? **(NOAA response for tomorrow)**
- Gov. Jindal asked about reports from the SCAT teams
- Adm. Watson Do not yet have the estimates of oil burned, skimmed and dispersed from yesterday. Will continue those operations today. Can we get estimate of both days for tomorrow?
- Adm. Watson did not yet have the tests back from the crab pot dip stick testing of the subsurface oil.
- Gov. Jindal have the tarballs recovered from Marsh Is. in Iberia get tested yet to see whether they are from the BP spill? (no) If it is related, it would be the furthest west that the oil has travelled.
- Eileen Sobeck (FWS) wildlife teams out yesterday and again today. (Report on wildlife impacts tomorrow?)
- Monica Medina NOAA seeing increased turtle strandings. Looking to see if there is a pattern that is related to the oil.
- Fish closures - NOAA expanded fisheries closure yesterday; watching the loop current issue closely. If oil moves into the loop current, there will likely be a large expansion of closed fisheries. (NOAA wants to maintain the safety and confidence in the seafood industry.)
- Gov. Jindal Monica mentioned that oil has moved passed booms and gotten into the marshes. What are the reasons for the oil getting past the boom? Failed boom; too much oil; subsea oil; improperly placed boom? David Kennedy did not know the answer in this case, but said boom is never a fail-safe solution.
- Gov. Jindal wants more boom moved to the West (although he acknowledged the 1000 new feet that arrived in Terrebonne
- Gov Jindal said he met with Col Lee of USACE yesterday to discuss barrier proposal. Col Lee was positive about the comments received on the proposal; and the Governor said that Adm. Landry has been supportive of the proposal. He urged us to expedite the barrier. Do we need to manage expectations?

SUMMARY OF NATIONAL RESPONSE TEAM CALL
TUESDAY, MAY 18, 2010

Situation Status:
-Riser insertion tool is capturing about 2,000 barrels/day and has been successful for the past 24 hours. A second tool is in place in case first tool fails.
-Window of opportunity for top kill is between now and May 25. The window of opportunity is dependent on pressure and temperatures. Still trying to get a better handle on associate risks.
-Third option for release control is stacking a second BOP.
-Four burns were conducted yesterday. The good weather window continues to continue surface operations with more burns and aerial dispersant application today.
-Subsurface dispersant injection is pending until monitoring vessel is on scene.
-Great deal of reporting on undersea plume and interaction with loop current --- need more focused messaging to explain what is happening subsurface and what happens to oil in loop current.
-Analysis of tarballs is being expedited.
-Interactions with Cuba and Caribbean are being initiated through Dept. of State.
-Proactive messaging today will be focused on managing impacts in Florida and a confident and agreed upon position on subsurface plume. Story tomorrow will be about Cuba.
-DHS offered to help to make sure NOAA has all of the aerial capabilities it needs.

Communications:
-Multiple people testifying today.
-Proactively analyzing tarballs and communicating that information (we expect results from tarballs found in Keys in 12 hours).
-Dr. Lubchenco is on media call to address the loop current --- significant news coverage today that oil is in loop current.
-FWS will hold a press call later today on impacts on turtles and other wildlife.

Legal:
-Briefing on Hill on current legislative proposal which will include proposed changes to Oil Spill Liability Trust Fund.

Intergovernmental:
-Email going out to all 50 states with information on loop current.
-Plan to also address loop current issue on the county/local call later today.

Congressional Affairs:
-Getting ready for hearings today and tomorrow.
-Coordinated plan needed for CODEL visits.

Dredging Proposal:

-Army Corps is playing out permitting process for viability of berm project --- this does not ensure funding or follow on of project implementation.
-While process is playing out, Gov. Jindal is talking to the press about the high likelihood of the project being approved.
-BP does not consider this project a response cost.
-NIC also believes that this is not an appropriate response mechanism.

SUMMARY OF DOC-NOAA DEEPWATER HORIZON UPDATE MEETING: TUESDAY MAY 18, 2010,

ACTIONS:

- Dispersant Workshop planning
- Hurricane/oil talking points, briefing at tomorrow's meeting
- Strategies to respond to the many requests for NOAA leadership to be at meetings in the Gulf
- 530 pm meeting is *on* for today.

MEETING MINUTES:

DISPERSANT ISSUES

- Planning by RRT/NOAA is underway for a Dispersant Workshop, to discuss the long term impacts of applying dispersant. Intent is to have this soon, within a few days. This would include not only government but also representatives from academia.
- Discussion about the long term costs and personnel needs for testing and monitoring. NOAA is developing a plan.
- Use of subsurface dispersant is much more effective than using dispersants on the surface oil.

FISHING CLOSURES

- 30-day closure rule will allow NOAA to amend closures simply by updating the maps online, instead of having to go through formal approval processes. OMB is examining this at the moment. This would be analogous to the online trajectory maps.
- No press release would be broadcast with each closure update; just the maps.
- Discussions are ongoing with FDA and NOAA on the closures relating to health impacts.

HURRICANES & OIL SPILL

- OMB has approved talking points developed in NOAA for how hurricanes would affect and be affected by the oil spill.
- Concern was raised about evacuating the thousands of people involved in the cleanup should a hurricane move into the spill area.
- Ahsha Tribble and Chris Smallcomb will brief the group tomorrow/1030am on the Hurricane Seasonal Outlook Press Conference that Dr. Lubchenco will participate in next week.

COMMUNICATIONS & OUTREACH

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- Proposal to have at least one political in the Gulf region each week. Another strategy would be to use leadership from other DOC bureaus.
- Bilingual capabilities are important for some of these meetings, where fishermen speak other languages (e.g. Vietnamese)
- Discussion about an interactive, multi-agency website providing resources and information for those impacted by the oil spill. This would be a major undertaking.
- A few challenges described keeping coordinated with White House on talking points and press releases.

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~ The newest 72-hr trajectory indicates that the plume continues to move west to southwest from the source.
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~ The closure measures 45,728 sq mi (118,435 sq km), which is approximately double the closure area that was previously in effect.

~ The majority of the expansion area is approximately 150 mi offshore, meaning that the pelagic longline fishery (which includes swordfish and tuna fisheries) is likely the fishery most affected by this change.
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~ Fish and Wildlife Service has continued response activities and monitoring surveys.
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How large is the stream of oil near the loop current?
What does the oil in the relief tube look like?
Does the volume of flow in relief tube give any indication of overall flow leakage rate?
Can you use flow rate from relief tube to estimate flow rate out of riser?
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Getbacks for NOAA
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ACTIONS:

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- Need to determine what is the "tipping point" for calling a fisheries disaster. This should include implications and public perception ramifications.

- NOAA needs to ensure that there are adequate resources to analyze the plume to properly define the characteristics (where is it, where is it going, extent, depth, etc.)
- DOC and NOAA need to establish a protocol for expanding fisheries closures that includes notification of OMB, preparing talking points, but is still responsive enough to stay ahead of the spill. If the reporting deadline is noon, then the protocol has to allow for posting then. A 24-hour lag is not responsive enough and is not acceptable.
- NOAA should post maps of where fisheries sampling is taking place.

UPDATES:

- ADM Allen will not back the Louisiana governor's proposal. BP has also determined that this is not an appropriate response mechanism, so will not fund it.
- A meeting is being held next week, hosted by the new NOAA assistant secretary to address concerns from civilian scientists who feel left out of the spill reaction.

SCHEDULING NOTES:

- The group will meet tomorrow at 5 p.m.

DHS SENIOR LEADERSHIP BRIEF: DEEPWATER HORIZON RESPONSE

GULF OF MEXICO 1200 EDT 18 MAY 2010

UPDATES IN BOLD BLUE

SECRETARY OF HOMELAND SECURITY PRIORITIES

- Ensure Responsible Party (RP) is doing everything it can to stop the oil leak.
- Ensure all capabilities (government, private, and commercial) and resources are being leveraged to protect the environment and facilitate a rapid, robust cleanup effort.
- Ensure every effort is being made to include and inform the local communities in support of response operations.

CURRENT SITUATION

- OIL STOPPAGE
    - RISER INSERTION TUBE TOOL (RITT)
        - **RITT remains inserted into riser. (USCG)**
            - **Drill Rig ENTERPRISE continuing recovery of an oil and gas mixture with no water. (USCG)**
            - **Recovery rate is estimated at 2,000 barrels per day. (USCG/UAC)**
            - **RITT-2 is being constructed and will be ready for deployment to the sea floor on 19 May. (NICC)**
                - **RITT-2 will be used if current RITT fails.(NICC)**
    - TOP HAT CONTAINMENT SYSTEM
        - **Top Hat remains on the seabed; standing-by pending effectiveness of the RITT. (USCG)**
    - TOP KILL
        - **Top Kill equipment being staged; commencement of operation no sooner than 23-25 May. (USCG)**
            - **Commencement pushed back due to ongoing preparations.**
    - RELIEF WELL
        - **Drill Rig DDII drilling operations scheduled to resume 18 May; current drill depth is 253 ft below the sea floor. (USCG)**
        - **Drill Rig DDIII drilling operations scheduled to resume 18 May; current drill depth remains 3,537 ft below sea floor. (USCG)**
    - BLOW OUT PREVENTER (BOP)
        - **Performing maintenance to BOP stack 18 May. (USCG)**

- OIL LANDFALL
    - **Unconfirmed reports of oil and tar balls at the following locations: East Dauphin Island, AL; Little Lagoon, AL; Fort Zachary State Park, Key West, FL; Panama City Beach, FL; Grand Isle, LA; Biloxi, MS; East Ship Island, MS; Long Beach, MS; Pascagoula, MS; and West Ship Island, MS. (USCG)**

- SHIPPING CHANNELS/PORTS

- All shipping channels and ports remain open in the Gulf Coast Region. (USCG)
  - No vessels have required cleaning or decontamination. (USCG)

- OPERATIONS
  - Oily water mixture recovered to date: 182,251 barrels. (USCG)
  - Booming operations continue, weather permitting. (USCG)

- DISPERSANTS
  - 3 surface dispersant sorties completed 17 May. (USCG)

- ASSETS ON SCENE:
  - Personnel: 20,281 (USCG/UAC)
  - Boom deployed: 1,782,900 ft (1,364,510 ft regular /418,390 ft sorbent) (USCG)
  - Dispersants deployed to date: 641,639 gallons(588,490 gallons surface/53,149 gallons subsea) (USCG)
  - Total Vessels Assigned:1013* (USCG/NIC)
  - Remotely Operated Vehicles: 12* (USCG)
  - Fixed-wing Aircraft: 17* (USCG/NIC)
  - Helicopters: 26* (USCG/NIC)

*Number does not include staged or ordered assets.

<u>AUTHORITIES</u>

- Homeland Security Presidential Directive 5 (HSPD 5).
- Oil Pollution Act of 1990 (OPA 90).
- National Response Framework (NRF).
- National Oil and Hazardous Substances Pollution Contingency Plan - 40 CFR 300.300.

<u>KEY SENIOR LEADERSHIP</u>

- Principal Federal Official: Secretary Napolitano, U.S. Department of Homeland Security.
- Secretary Salazar: U.S. Department of the Interior.
- Director Birnbaum: U.S. Minerals Management Service (MMS).
- Administrator Jackson: U.S. Environmental Protection Agency.
- National Incident Commander: Admiral Allen, Commandant, USCG.
- Federal On-Scene Coordinator (FOSC): Rear Admiral Landry, Commander, USCG, District 8, New Orleans, LA.
- Responsible Party: British Petroleum (BP) and Transocean.

<u>FEDERAL AGENCIES/DEPARTMENTS</u>

- U.S. Coast Guard (USCG)

  - Shoreline Cleanup and Assessment Teams (SCAT) are sampling oil and tar balls; clean up action being taken by BPs oil spill recovery organization.

- CUSTOMS AND BORDER PROTECTION (CBP)
  - OAM continues to provide 2 aircraft to provide advisory information to spotter and tanker aircraft conducting spray operations.

- FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)
  - Region IV at Level IV operations (Steady-State).
  - Has not received any requests for Federal assistance.

- TRANSPORTATION SECURITY ADMINISTRATION (TSA)
  - TSA continues to monitor the situation for any potential impact to transportation.

- DEPARTMENT OF AGRICULTURE (USDA)
  - Animal and Plant Health Inspection Service supporting wildlife activities in LA.

- DEPARTMENT OF DEFENSE (DOD)
  - 2 Vessel Skimming Systems being shipped from AK; ETA 22 May.
  - 3 civilian offshore support vessels (OSV), OVS WES BORDELON, OSV JOHN COGHILL, and OSV VANGUARD have been contracted by DoD.
  - 1,632associated personnel deployed in support of spill response.
  - 100 Title 10 personnel and 1,441Title 32 National Guard members deployed.

- ENVIRONMENTAL PROTECTION AGENCY (EPA)
  - USCG and EPA authorized BP to use subsea dispersants.
  - Continuing monitoring and sampling of air, water and sediment.

- HEALTH AND HUMAN SERVICES (HHS)
  - National Institute for Occupational Safety and Health (NIOSH) established plans to visit BP worker training staging areas in AL, FL, LA and MS.
  - Agency for Toxic Substance Disease Registry provided a draft document entitled *Dispersants & Safety in Seafood* to the Food and Drug Administration for review.

- DEPARTMENT OF THE INTERIOR (DOI)
  - MMS reports some success is being achieved through the use of the RITT and that a larger tool is being constructed to siphon oil from the leaking riser.

- NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
  - Weather forecast:
    - Tuesday, 18 May: West winds 5-10 knots; seas 2 ft or less.

- Wednesday, 19 May: Northeast winds 5-10 knots (am)/southeast winds 5-10 knots (pm); seas 2 ft or less.
- Thursday, 20 May: Southeast winds 5-10 knots; seas 2-3 ft.

CRITICAL INFRASTRUCTURE KEY RESOURCES (CIKR)

- National Infrastructure Coordinating Center (NICC)
    - Revisions to the Federal closure in the exclusive economic zone allowed reopening of some oyster harvesting areas in Terrebonne Parish, LA.

STATE AND LOCAL AGENCIES

- Louisiana, Mississippi, Alabama, Texas, and Florida communicating daily with DHS.

NATIONAL OPERATIONS CENTER

- Current Posture: Phase 2 Concern; Crisis Action Team activated.

The next SLB is scheduled for 1800 EDT 18 May

SUMMARY:
TELECON WITH LOCAL OFFICIALS

BRIEFING:
Coast Guard Captain James Hanzalik

Riser insertion tube into the riser - gathering 2,000 barrels per day.

Controlled burns yesterday and today was a good burn day as well - reports can be expected tomorrow.

Boom update for Gulf States
Charlie Henry, NOAA
Expectations on loop current and slick:

- Bulk of oil is north of current
- Limited amount of oil susceptible to the current
- Reviewing transport pattern, looking at 10 or more days

QUESTIONS/COMMENTS:
Michele Tassin, Emergency Operations Center Director, Plaquemines Parish
.
Question: Is satellite imagery available online?
- Lori Faeth Answer: Good information is available at www.deepwaterhorizonresponse.com

- Dan Dealy, Mobile, Alabama, Answer: www.skytruth.org
8e&URL=http%3a%2f%2fwww.skytruth.org> also has useful information

Dan Dealy, Mobile, Alabama

Question: Do you have a further update on the research being conducted on underwater plumes?

o Charlie Henry Answer: Samples are not accurate due to the way the droplets disperse. Larger droplets rise quickly to the surface while the smaller droplets stay below. NOAA does not view underwater plumes as a significant threat at this time and is working to get a better projection on deep water currents to determine short and long-term implications. This analysis will be forthcoming in the days ahead. With regard to concerns that subsea dispersants are correlated to underwater plume, NOAA does notsee a correlation. At the time of the inquiry, there were only a few days of subsea dispersant activity, so NOAA does not think subsea dispersant was a significant driver.

Bill Melton, Environmental Services Director, Mobile County Public Works

Question: Following up on yesterday's question on economic impact loss for impacted areas.

o Captain Hanzalik: Also will make sure that commerce is on the phone to answer the question tomorrow.

o Jane, SBA: Working on declarations for small business loans

o Heather Smith, DHS: This info is available on www.deepwaterhorizonresponse.com

o Nandi Chhabra, WH: We will follow up with Melton individually, and also on the call tomorrow.

good evening everyone,
attached is a compilation of notes from noaa leadership meetings on tuesday, may 18, 2010.
let me know if there are any modifications necessary.
best,
jen

SUMMARY OF NOAA LEADERSHIP DAILY DEEPWATER HORIZON 8 AM BRIEFING
TUESDAY, MAY 18, 2010
Call Guidelines:
·Place your phone on mute at all times unless you are speaking
·Do not place your phone on hold

Additional Attachments
Task list record of actions from 0800 Daily NOAA calls as of 5/18 (this is for reference only)

Action Items
·Follow-up on research platforms that could be deployed and sampling plan from all assets (Murawski and team, report in advance of afternoon testimony)
·Expert briefing for Loop Current (Kenney)
·Histogram by day for turtle strandings (NMFS)
·Request for talking points for turtle strandings (NMFS)
·Precautionary closure of fisheries due to potential of oil in the loop current (NMFS)
·Assign technical point for OMB, DOC, FDA group regarding seafood safety; Steve Wilson and Tim Hansen can serve this role.
·Need to have talking points and alert Cuba and Mexico regarding fishery closure and potential of oil in loop current (Turner)
·Alert WH of fishery closure change (Sarri)
·Talking points on loop current, fishery closure, international, states – what we are doing to address the potential that oil is in the loop current (Murawski, Mclean, Turner to send to Kenney by 10am)

Documents cleared through WH clearance process for 5/11/10
(currently, this list is incomplete but will be updated on a daily basis)

FACT SHEETS – CLEARED & POSTED ONLINE
·Booms
·Coral reefs & oil
·Marine mammals and sea turtles
·Gulf of Mexico Oil Spill General (Fish)
·Fish stocks in the Gulf of Mexico
·Seafood safety
·Impact of crude oil on seafood
·Natural Resources Damage Assessment
·Shorelines and coastal habitats in the Gulf of Mexico
·Dispersants (OR&R sheet)
·Shoreline & habitats (OR&R sheet)
·Shoreline Cleanup and Assessment Technique (SCAT) (OR&R sheet)

FACT SHEETS – IN CLEARANCE/WORK
·Sheen (cleared/not posted)
·Oil weathering/types
·Loop current
·Mussel Watch
·NOS activities
·Hypoxia (dead zone) & oil

Websites for more information:
OR&R Response Outreach – http://response.restoration.noaa.gov/deepwaterhorizon (cleared fact sheets)

Deepwater Horizon JIC – www.deepwaterhorizonresponse.com (cleared factsheets)
ResponseLink – https://responselink.orr.noaa.gov
NOAA ICC Sitreps - https://www.homelandsecurity.noaa.gov/icc_sitreps.html
Updates on Fisheries Closure – http://sero.nmfs.noaa.gov/
Daily updates to NOAA nautical charts: http://www.nauticalcharts.noaa.gov/.

Joint Information Center Contacts (as of 5/11/10)
David Miller / 202-329-4030 (LA) david.p.miller@noaa.gov (through Monday, May 17th)
Monica Allen (NOAA Fisheries Communications) is there this week (5/15-20). Her cell # is 202/379-6693.
Replacement: Rachel Wilhelm arrives Sat., May 15th / 202-657-9816.

NOAA Scientific Scientist Coordination on site (as of 5/17/10)
Charlie Henry (206-849-9928) – Robert, LA
LCDR Demian Bailey (206-518-1941) - Robert, LA
Ed Levine (206-849-9941) - Houma, LA
Jordon Stout (206-321-3320) - Houma, LA
Frank Csulak (732-371-1005) - Houma, LA
Ruth Yender (206-849-9926) – Mobile, AL
LCDR Liz Jones (206-849-9918) - Mobile, AL
John Whitney (907-440-8109)- Mobile, AL
Brad Benggio (206-849-9923) - St. Petersburg, FL
LTJG Josh Slater (206-462-0710) – Mobile, AL
Mark Miller (206-713-0640) - NIC, Washington DC
Carl Jochums – NOAA contractor boom expert on site.

SUMMARY OF DAILY CALLS WITH THE GOVERNORS: DEEPWATER HORIZON UPDATE MEETING: TUESDAY, MAY 18, 2010,

Moderator: Valerie Jarrett
Governors: Jindal

· EPA – applying subsea dispersant (when monitoring ship is in place). Will switch dispersants today based on toxicity. (Action: provide info on new dispersants and reasons)
· Gov. Jindal – questioned the accuracy of the trajectories – he noted that there was significantly more oil along the shoreline than what had been projected. Why is that? Monica
· Gov. Jindal – did the burning, skimming and surface dispersants application get factored into to today's trajectory? (NOAA response for tomorrow)
· Gov. Jindal – asked about reports from the SCAT teams
· Adm. Watson – Do not yet have the estimates of oil burned, skimmed and dispersed from yesterday. Will continue those operations today. Can we get estimate of both days for tomorrow?
· Adm. Watson – did not yet have the tests back from the crab pot dip stick testing of the subsurface oil.
· Gov. Jindal – have the tarballs recovered from Marsh Is. in Iberia get tested yet to see whether they are from the BP spill? (no) If it is related, it would be the furthest west that the oil has travelled.
· Eileen Sobeck (FWS) – wildlife teams out yesterday and again today. (Report on wildlife impacts tomorrow?)
· Monica Medina – NOAA seeing increased turtle strandings. Looking to see if there is a pattern that is related to the oil.
· Fish closures - NOAA expanded fisheries closure yesterday; watching the loop current issue closely. If oil moves into the loop current, there will likely be a large expansion of closed fisheries. (NOAA wants to maintain the safety and confidence in the seafood industry.)
· Gov. Jindal – Monica mentioned that oil has moved passed booms and gotten into the marshes. What are the reasons for the oil getting past the boom? Failed boom; too much oil; subsea oil; improperly placed boom? David Kennedy did not know the answer in this case, but said boom is never a fail-safe solution.
· Gov. Jindal – wants more boom moved to the West (although he acknowledged the 1000 new feet that arrived in Terrebonne

· Gov Jindal – said he met with Col Lee of USACE yesterday to discuss barrier proposal. Col Lee was positive about the comments received on the proposal; and the Governor said that Adm. Landry has been supportive of the proposal. He urged us to expedite the barrier. Do we need to manage expectations?

SUMMARY OF NATIONAL RESPONSE TEAM CALL
TUESDAY, MAY 18, 2010
Situation Status:
-Riser insertion tool is capturing about 2,000 barrels/day and has been successful for the past 24 hours. A second tool is in place in case first tool fails.
-Window of opportunity for top kill is between now and May 25. The window of opportunity is dependent on pressure and temperatures. Still trying to get a better handle on associate risks.
-Third option for release control is stacking a second BOP.
-Four burns were conducted yesterday. The good weather window continues to continue surface operations with more burns and aerial dispersant application today.
-Subsurface dispersant injection is pending until monitoring vessel is on scene.
-Great deal of reporting on undersea plume and interaction with loop current --- need more focused messaging to explain what is happening subsurface and what happens to oil in loop current.
-Analysis of tarballs is being expedited.
-Interactions with Cuba and Caribbean are being initiated through Dept. of State.
-Proactive messaging today will be focused on managing impacts in Florida and a confident and agreed upon position on subsurface plume. Story tomorrow will be about Cuba.
-DHS offered to help to make sure NOAA has all of the aerial capabilities it needs.

Communications:
-Multiple people testifying today.
-Proactively analyzing tarballs and communicating that information (we expect results from tarballs found in Keys in 12 hours).
-Dr. Lubchenco is on media call to address the loop current --- significant news coverage today that oil is in loop current.
-FWS will hold a press call later today on impacts on turtles and other wildlife.

Legal:
-Briefing on Hill on current legislative proposal which will include proposed changes to Oil Spill Liability Trust Fund.

Intergovernmental:
-Email going out to all 50 states with information on loop current.
-Plan to also address loop current issue on the county/local call later today.

Congressional Affairs:
-Getting ready for hearings today and tomorrow.
-Coordinated plan needed for CODEL visits.

Dredging Proposal:
-Army Corps is playing out permitting process for viability of berm project --- this does not ensure funding or follow on of project implementation.
-While process is playing out, Gov. Jindal is talking to the press about the high likelihood of the project being approved.
-BP does not consider this project a response cost.
-NIC also believes that this is not an appropriate response mechanism.

SUMMARY OF DOC-NOAA DEEPWATER HORIZON UPDATE MEETING: TUESDAY
MAY 18, 2010,

ACTIONS:
· Dispersant Workshop planning
· Hurricane/oil talking points, briefing at tomorrow's meeting
· Strategies to respond to the many requests for NOAA leadership to be at meetings in the Gulf
· 530 pm meeting is on for today.

MEETING MINUTES:

DISPERSANT ISSUES
· Planning by RRT/NOAA is underway for a Dispersant Workshop, to discuss the long term impacts of applying dispersant. Intent is to have this soon, within a few days. This would include not only government but also representatives from academia.
· Discussion about the long term costs and personnel needs for testing and monitoring. NOAA is developing a plan.
· Use of subsurface dispersant is much more effective than using dispersants on the surface oil.

FISHING CLOSURES
· 30-day closure rule will allow NOAA to amend closures simply by updating the maps online, instead of having to go through formal approval processes. OMB is examining this at the moment. This would be analogous to the online trajectory maps.
· No press release would be broadcast with each closure update; just the maps.
· Discussions are ongoing with FDA and NOAA on the closures relating to health impacts.

HURRICANES & OIL SPILL
· OMB has approved talking points developed in NOAA for how hurricanes would affect and be affected by the oil spill.
· Concern was raised about evacuating the thousands of people involved in the cleanup should a hurricane move into the spill area.
· Ahsha Tribble and Chris Smallcomb will brief the group tomorrow/1030am on the Hurricane Seasonal Outlook Press Conference that Dr. Lubchenco will participate in next week.

COMMUNICATIONS & OUTREACH
· Many requests for NOAA leadership to be at meetings in the Gulf region, both technical and political people.
· Proposal to have at least one political in the Gulf region each week. Another strategy would be to use leadership from other DOC bureaus.
· Bilingual capabilities are important for some of these meetings, where fishermen speak other languages (e.g. Vietnamese)
· Discussion about an interactive, multi-agency website providing resources and information for those impacted by the oil spill. This would be a major undertaking.
· A few challenges described keeping coordinated with White House on talking points and press releases.

SUMMARY OF CONGRESSIONAL STAFF CONFERENCE CALL ON THE GULF OF MEXICO OIL SPILL

Facilitator
Chani Wiggins, Asst. Sec. of Legislative Affairs, U.S. Department of Homeland Security (DHS)

Speakers/Agency Representatives Included:
Rear Adm. Cook, USCG Director of Prevention Policy
Walter Cruickshank, MMS Deputy Director
Doug Helton, NOAA OR&R Incident Operations Coordinator
Roy Crabtree, NMFS Regional Administrator, SE Region
Greg Siekaniec, Chief, National Wildlife Refuge System, US F&W Service

Congressional Participants Included (Not all participants were announced)
Staff with House Energy and Commerce Committee

Staff with House Science and Technology Committee
Staff with Senate Homeland Security and Governmental Affairs Committee
Staff for Rep. Gus Bilirakis (R-9th, FL)
Staff for Rep. Kendrick Meek (D-17th, FL)
Staff for Rep. Bill Cassidy (R-6th, LA)

Remarks from Rear Admiral Cook
- The riser insertion tool has effectively relieved some pressure on the well head and the tool is assisting in the recovery of approximately 2,000 barrels of oil per day
- There have been no changes to oil expressions on the surface as a result of using the riser
8,000 gal. of subsurface dispersants have been applied in the last 24 hrs.
- Dispersant application is currently on hold; we are waiting for a vessel to arrive on site to monitor dispersant application.
- Overall dispersants applied: 588,000 gal on the surface 50,000 gal subsurface
- 1.7 million feet of boom have been deployed overall
- 4 in-situ burns occurred yesterday
- 20 tarballs washed ashore in Key West, FL yesterday. Samples of these balls were sent off for processing to determine if their chemical signature matches that of oil in the Deepwater Horizon spill. Results should be received in the next day or two.
- Tarballs have also been recovered in Pascagoula, MS and at other locations in the Delta region
- Tarballs are easier to recover from shore, but if they are suspended in the water column, there is the potential for them to bypass booms
- 36 wildlife impacts reported thus far
- Tally of responders associated with spill has increased to 20,000 people and 1,000 vessels
- Over 15,000 total claims filed to date, BP has approved all claims submitted to date and almost 400 people at work performing claims processing

Remarks from Walter Cruickshank
- Reiterated the effectiveness of the insertion tool, recovering on average 2,000 barrels of oil per day
- Recovery is a mix of oil and natural gas
- We are recovering an increasing in amount of natural gas
- We are continuing preparations for the top kill
- The pod is being reset and the remainder of the necessary equipment should be in place by weekend. We should be able to begin operations early next week.
- Relief well drilling is moving forward, 85,000 ft total depth of well thus far

Remarks from Doug Helton
- The newest 72-hr trajectory indicates that the plume continues to move west to southwest from the source.
- We note that the oil sheen is moving toward the edge of the loop current; right now oil appears to have entered a loop current boundary gyre.
- We cannot confirm whether or not the oil plume is entrained in the loop current itself at this point. Aircraft flyovers scheduled in the next few days should help inform this effort.
- Oil impacts on shore have been noted in the Delta region, and approximately 2 km of oiled marshes have been observed. The Shoreline Cleanup Assessment Team has been deployed.

Remarks from Roy Crabtree
- As of 6:00pm today, NOAA Fisheries is expanding the eastern and southern boundaries of the closure to encompass the reported actual location and projected path of the oil based on initialization data and the 72-hour trajectory to incorporate full extent of trajectory and to address the possibility of oil entry into the loop current.
- The closure measures 45,728 sq mi (118,435 sq km), which is approximately double the closure area that was previously in effect.
- The majority of the expansion area is approximately 150 mi offshore, meaning that the pelagic longline fishery (which includes swordfish and tuna fisheries) is likely the fishery most affected by this change.
Remarks from Greg Siekaniec
- Fish and Wildlife Service has continued response activities and monitoring surveys.
- We continue to collect reports of affected sea turtles and other wildlife through our hotline.

- Oil has thus far been observed on 4 National Wildlife Refuges.

Questions Raised by Congressional Members and Staff
How many gallons of dispersant has been released to date?
How large is the stream of oil near the loop current?
What does the oil in the relief tube look like?
Does the volume of flow in relief tube give any indication of overall flow leakage rate? Can you use flow rate from relief tube to estimate flow rate out of riser?
Dr. Lubchenco mentioned in an earlier public/press statement that NOAA has been working right from the start on this spill, but needs more assets. What assets was she referring to?

Getbacks for NOAA
- Provide context and more information regarding the assets NOAA needs that Dr. Lubchenco referred to in her earlier statement. (OLA to coordinate with NOAA Communications on where this statement may have come up and what was said)

SUMMARY OF DOC-NOAA DEEPWATER HORIZON UPDATE MEETING: TUESDAY, MAY 18, 2010,
ACTIONS:
· Need to determine the chemical composition of the dispersants so that we can definitively know what we are testing for.
· Need to determine what is the "tipping point" for calling a fisheries disaster. This should include implications and public perception ramifications.
· NOAA needs to ensure that there are adequate resources to analyze the plume to properly define the characteristics (where is it, where is it going, extent, depth, etc.)
· DOC and NOAA need to establish a protocol for expanding fisheries closures that includes notification of OMB, preparing talking points, but is still responsive enough to stay ahead of the spill. If the reporting deadline is noon, then the protocol has to allow for posting then. A 24-hour lag is not responsive enough and is not acceptable.
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DHS SENIOR LEADERSHIP BRIEF: DEEPWATER HORIZON RESPONSE
GULF OF MEXICO 1200 EDT 18 MAY 2010
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· Principal Federal Official: Secretary Napolitano, U.S. Department of Homeland Security.
· Secretary Salazar: U.S. Department of the Interior.
· Director Birnbaum: U.S. Minerals Management Service (MMS).
· Administrator Jackson: U.S. Environmental Protection Agency.
· National Incident Commander: Admiral Allen, Commandant, USCG.
· Federal On-Scene Coordinator (FOSC): Rear Admiral Landry, Commander, USCG, District 8, New Orleans, LA.
· Responsible Party: British Petroleum (BP) and Transocean.

FEDERAL AGENCIES/DEPARTMENTS

- U.S. Coast Guard (USCG)
  - Shoreline Cleanup and Assessment Teams (SCAT) are sampling oil and tar balls; clean up action being taken by BPs oil spill recovery organization.

- CUSTOMS AND BORDER PROTECTION (CBP)
  - OAM continues to provide 2 aircraft to provide advisory information to spotter and tanker aircraft conducting spray operations.

- FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)
  - Region IV at Level IV operations (Steady-State).
  - Has not received any requests for Federal assistance.

- TRANSPORTATION SECURITY ADMINISTRATION (TSA)
  - TSA continues to monitor the situation for any potential impact to transportation.

- DEPARTMENT OF AGRICULTURE (USDA)
  - Animal and Plant Health Inspection Service supporting wildlife activities in LA.

- DEPARTMENT OF DEFENSE (DOD)
  - 2 Vessel Skimming Systems being shipped from AK; ETA 22 May.
  - 3 civilian offshore support vessels (OSV), OVS WES BORDELON, OSV JOHN COGHILL, and OSV VANGUARD have been contracted by DoD.
  - 1,632 associated personnel deployed in support of spill response.
  - 100 Title 10 personnel and 1,441 Title 32 National Guard members deployed.

- ENVIRONMENTAL PROTECTION AGENCY (EPA)
  - USCG and EPA authorized BP to use subsea dispersants.
  - Continuing monitoring and sampling of air, water and sediment.

- HEALTH AND HUMAN SERVICES (HHS)
  - National Institute for Occupational Safety and Health (NIOSH) established plans to visit BP worker training staging areas in AL, FL, LA and MS.
  - Agency for Toxic Substance Disease Registry provided a draft document entitled Dispersants & Safety in Seafood to the Food and Drug Administration for review.

- DEPARTMENT OF THE INTERIOR (DOI)
  - MMS reports some success is being achieved through the use of the RITT and that a larger tool is being constructed to siphon oil from the leaking riser.

- NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
  - Weather forecast:
- Tuesday, 18 May: West winds 5-10 knots; seas 2 ft or less.
- Wednesday, 19 May: Northeast winds 5-10 knots (am)/southeast winds 5-10 knots (pm); seas 2 ft or less.
- Thursday, 20 May: Southeast winds 5-10 knots; seas 2-3 ft.

CRITICAL INFRASTRUCTURE KEY RESOURCES (CIKR)

- National Infrastructure Coordinating Center (NICC)
  - Revisions to the Federal closure in the exclusive economic zone allowed reopening of some oyster harvesting areas in Terrebonne Parish, LA.

STATE AND LOCAL AGENCIES

- Louisiana, Mississippi, Alabama, Texas, and Florida communicating daily with DHS.

NATIONAL OPERATIONS CENTER

- Current Posture: Phase 2 – Concern; Crisis Action Team activated.

The next SLB is scheduled for 1800 EDT 18 May

SUMMARY:
TELECON WITH LOCAL OFFICIALS

BRIEFING:
Coast Guard Captain James Hanzalik

Riser insertion tube into the riser - gathering 2,000
barrels per day.

Controlled burns yesterday and today was a good burn day
as well - reports can be expected tomorrow.

Boom update for Gulf States
Charlie Henry, NOAA
Expectations on loop current and slick:

o Bulk of oil is north of current
o Limited amount of oil susceptible to the current
o Reviewing transport pattern, looking at 10 or more days

QUESTIONS/COMMENTS:
Michele Tassin, Emergency Operations Center Director, Plaquemines Parish
.
Question: Is satellite imagery available online?
o Lori Faeth Answer: Good information is available at
www.deepwaterhorizonresponse.com

o Dan Dealy, Mobile, Alabama, Answer: www.skytruth.org
8e&URL=http%3a%2f%2fwww.skytruth.org> also has useful information

Dan Dealy, Mobile, Alabama

Question: Do you have a further update on the research being conducted on underwater plumes?
o Charlie Henry Answer: Samples are not accurate due to the way the droplets disperse. Larger droplets rise quickly to the surface while the smaller droplets stay below. NOAA does not view underwater plumes as a significant threat at this time and is working to get a better projection on deep water currents to determine short and long-term implications. This analysis will be forthcoming in the days ahead. With regard to concerns that subsea dispersants are correlated to underwater plume, NOAA does not see a correlation. At the time of the inquiry, there were only a few days of subsea dispersant activity, so NOAA does not think subsea dispersant was a significant driver.

Bill Melton, Environmental Services Director, Mobile County Public Works

Question: Following up on yesterday's question on economic impact loss for impacted areas.
o Captain Hanzalik: Also will make sure that commerce is on the phone to answer the question tomorrow.

o Jane, SBA: Working on declarations for small business loans

o Heather Smith, DHS: This info is available on
www.deepwaterhorizonresponse.com

o Nandi Chhabra, WH: We will follow up with Melton individually, and also on the call tomorrow.

Received(Date): Wed, 19 May 2010 12:46:43 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP GUlf of Mexico Update: May 18, 2010
To: Caren.Madsen@noaa.gov, Adele.Stevens@noaa.gov, Amanda.Hallberg@noaa.gov,asalzman@ceq.eop.gov, Dewey.Amy@epa.gov,Andrea Bleistein <Andrea.Bleistein@noaa.gov>, Andrew.Winer@noaa.gov,Beth.Dieveney@noaa.gov, perciasepe.bob@epa.gov, Bobby.Whithorne@dhs.gov,"Boots, Michael J." <Michael_J._Boots@ceq.eop.gov>, Tulis.dana@epa.gov,David.Holst@noaa.gov, dietrich.debbie@epa.gov, Thompson.diane@epa.gov,Drew.schneider@dhs.gov, Eric.Schwaab@noaa.gov, Fayrouz.saad@dhs.gov,gguzy@ceq.eop.gov, gnelson@who.eop.gov, Jainey.Bavishi@noaa.gov,Woodka.Janet@epa.gov, Jarrod.bernstein@dhs.gov, Jim.Lecky@noaa.gov,John.Gray@noaa.gov, John.Rapp@noaa.gov, JCarson@ceq.eop.gov,Jon_Jarvis@nps.gov, "Jourdane, Jonathan" <Jonathan_Jourdane@ios.doi.gov>,Kanninen.Daniel@epamail.epa.gov, Gage.Katharine@epamail.epa.gov,Kellyn.Blossom@dhs.gov, lrobinson@doc.gov, Margaret.Spring@noaa.gov,MWeiss@ceq.eop.gov, shapiro.mike@epa.gov, Gguernica@ceq.eop.gov,"Modi, Kalpen S." <Kalpen_S._Modi@who.eop.gov>, Noah.Kroloff@dhs.gov,Owens.Stephanie@epamail.epa.gov, rfried@ceq.eop.gov, Ray_Rivera@ios.doi.gov,Sussman.Bob@epa.gov, Rowan_Gould@fws.gov, Sternberg.Shira@epamail.epa.gov,Stephanie.tennyson@dhs.gov, Tracy.Hannah@dhs.gov

Gulf of Mexico Oil Spill Response Update

05/18/2010

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;

2. On the Surface to minimize impacts of the spill; and

3. Onshore to protect the shoreline and inform the public.

Highlights

ξ 20,281 personnel responding as part of the Unified Command, plus volunteers. An increase of more than 3,000 since Sunday.

ξ Subsea dispersant application continues, 8,000 gallons injected on Monday.

- 230 additional specialty response vessels at work today.

- 1,000,000 gallons of oily water recovered and treated since yesterday.

- Three new claims centers open   More than $12 million in claims paid.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

1. **Riser Insertion Tube** The riser insertion tool was successfully placed into the leaking riser on Monday, and the tube is capturing some of the oil and gas. Crews on the surface are working to optimize recovery rates. This remains a new technology and both its continued operation and its effectiveness in capturing the oil and gas remain uncertain.

2. **Dispersant injection at the sea floor** Dispersant was applied directly at the leak site on Sunday and again on Monday night. Roughly 15,500 gallons were applied during the two periods using Remote Operated Vehicles (ROVs). The dispersant acts by separating the oil into small droplets that can break down more easily through natural processes before it reaches the surface. Sonar testing and aerial photographs show encouraging results. Additional subsea applications are subject to ongoing testing protocols developed with the Environmental Protection Agency and other federal and state agencies.

3. "Top Kill" Activities

- Equipment is on location near the blowout preventer (BOP) to begin work on killing the well from the top. Manifold and bypass lines are in place to connect to valves on the BOP. Through these valves, engineers will attempt first to pump heavy fluids and cement directly downhole to kill the well.

- An additional option to control pressure is to inject a "junk shot" of shredded fibrous material into the BOP through these lines. The material will travel up the BOP and clog the flow of the well. Once the pressure is controlled, heavy fluids and cement can be

pumped down the well to kill it.

ξ Diagnostics are ongoing. Gamma ray surveys have been conducted to determine the status of internal components and pressures inside the blowout preventer.

4. Drilling relief wells On Sunday, Transocean's drillship *Development Driller II,* began drilling the second relief well. Like the first relief well, this one is approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. The first relief well was "spudded" by Transocean *Development Driller III* on Sunday, May 2, in a water depth of roughly 5,000 feet. This well has been drilled to 9,000 feet below sea level. It has been cased and cemented to that depth. Testing of the BOP is continuing and drilling should begin again within a couple of days. It is estimated the total drilling process will take at least 90 days. Once that is accomplished, and the original well has been penetrated, heavy fluids and cement can be pumped downhole to kill the well.

5. Containment Recovery System

ξ A containment dome, called a "top hat," has been deployed to the sea floor and is readied to be placed over the main leak, if needed. It is designed with injection ports that can accommodate "anti-freeze" in order to mitigate the formation of large volumes of frozen hydrates.

ξ It is important to note that this technology has never been used at this water depth. Significant technical and operational challenges must be overcome for it to be successful.

Offshore – Surface Spill Response

ξ **Cleanup Vessels** 950 specialty response vessels are now deployed, including tugs, barges and recovery boats. 46 of the boats are skimmers, designed to separate oil from water. Approximately 182,251 barrels of oil-water mix (7.65 million gallons) have been recovered and treated.

ξ **Surface Dispersant** 588,416 gallons of dispersant have been applied on the surface by aircraft. The dispersant is a biodegradable chemical that works like soap by separating the oil into small droplets that can be more easily broken down by natural

processes. An additional 308,000 gallons are available for deployment.

- **In-Situ Burning** The Unified Command conducted four in-situ burns on Monday. The in-situ burning occurs on the surface using special fire-boom that collects surface hydrocarbons which are then burned off.

Onshore - Shoreline Protection and Community Outreach

- **BP Announces $70 million in Tourism Grants to States** On Monday, BP CEO Tony Hayward announced the company will make an additional $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism. This money is in addition to the $100 million in block grants for accelerated implementation of Area Contingency Plans announced on May 4. <u>It is also supplemental to BP's private claims process, which remains unchanged</u>.

- **$25 Million Block Grants to 4 States** On May 4, BP announced it would provide Louisiana, Florida, Mississippi and Alabama $25 million each to accelerate implementation of the States' approved Area Contingency Plans. The Contingency Plans address removal of a worst case spill and are designed to mitigate or prevent a substantial threat to sensitive areas. The money will enable local businesses to immediately support clean-up and recovery efforts. <u>The grant is supplemental to BP's private claims process, which remains unchanged</u>.

- **Oil Containment and Shoreline Protection** 1,800,000 feet of both sorbent and barrier boom have been deployed or staged to protect sensitive coastal areas. An additional 1,150,000 feet of boom is being directed to staging areas.

- **"Vessels of Opportunity" Program** 4,581 contracts have been approved and 1,339 vessels are active and getting paid. Participating vessels are being organized into 25-boat task force teams to help with a variety of clean-up activities, including transporting supplies, performing wildlife rescue, and towing and deploying booms. To qualify for the program, operators need to meet several key requirements, including attending a four-hour hazardous waste training session, passing a dockside examination by the U.S. Coast Guard, and meeting crewing requirements based on the size of the vessel provided. 54 training sessions have been held across the four states.

The contact number for people interested in registering for the program is (281) 366-5511 and information about training can be found on the incident website at www.deepwaterhorizonresponse.com under “volunteers.” For additional information about training call (866) 905-4492.

- **Volunteers and Training** BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Training ramped up significantly this week, with sessions held at multiple locations across the Gulf. As of today, more than 15,000 volunteers have been trained in five different training modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under “volunteers.”

- **Informing Community Leaders** The Unified Command continues to hold twice-daily teleconferences with mayors and community leaders across Mississippi, Alabama and Florida to ensure that elected officials have an opportunity to be updated on Command activities and to ask questions.

- **Wildlife Activities** 1 additional report of impacted wildlife was received, bringing the total to 36. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

- **Claims for Damages** - BP has opened 17 claims offices to help claimants through the process. Vietnamese and Spanish translators are in some offices. 17,000 claims have been filed and approximately 3,400 of them have been paid, an increase of 700 since Monday. Approximately $12 million has been paid out. Most of the claims are for loss of income or wages in commercial fishing, shrimping and oyster harvest, and associated processing facilities. The contact number for claims is (800) 440-0858. Claims office locations are listed below.

Summary of Regional Operations and Outreach

Louisiana Sites:	Robert	Unified Area Command
	Houma	Incident Command Post
	Pointe A La Hache	Community Outreach Cer
	Venice	Community Outreach Center, Staging
	Grand Isle	Staging Area
	Port Fourchon	Staging Area

Cocodrie Staging Area

Shell Beach Staging Area

Slidell Staging Area

St. Mary Staging Area

Amelia
Staging Area

Belle Chasse **Claims Office**

2766 Belle Chasse Hwy

Belle Chasse, LA 70037

Cut Off **Claims Office**

Tarpon Heights Shopping Center

Unit 2

16263 E. Main Street

Cut Off, LA 70345

Grand Isle **Claims Office**

3811 LA 1

Grand Isle, LA 70358

Hammond **Claims Office**

Worley Operations Center

303 Timber Creek

Hammond, LA 70404

Houma **Claims Office**

Plaza Caillou Shopping Center

814 Grand Caillou Road

Suite 2 & 3

Houma, LA 70363

Pointe A La Hache **Claims Office**

1553 Hwy 15

Pointe A La Hache, LA

St. Bernard **Claims Office**

	1345 Bayou Rd Saint Bernard, LA 70085
	Venice **Claims Office** 41093 Hwy LA 23 Boothville, LA 70038

ξ Community Outreach Centers now open in 8 parishes.

ξ New Claims Office for Terrebonne Parish opened at Houma.

ξ Continuing to add adjusters to help process claims and working with translators to ensure that Vietnamese and Spanish speaking communities are served.

ξ Working with the State to coordinate food stamp programs.

ξ Working with Catholic Charities to deliver immediate community needs of food and clothing.

Mississippi Sites:	Pascagoula Community Outreach Center, Staging Area
	Biloxi Community Outreach Center, Staging Area
	Waveland Community Outreach Center
	Pass Christian Staging Area
	Bay St. Louis **Claims Office** 1171 Highway 90 Bay St. Louis, MS 39520
	Biloxi **Claims Office** 920 Cedar Lake Rd, Suite K Biloxi, MS 39532
	Pascagoula **Claims Office** 5912 Old Mobile Hwy

	Suite 4 Pascagoula, MS 39563

ξ Community outreach centers are now open in all three coastal counties.

ξ New Claims Office for Hancock County opened in Bay St. Louis.

ξ Continuing to coordinate training for vessel operators and working on Vessels of Opportunity deployment.

Alabama Sites:	Mobile Incident Command Post, Community Outreach Center
	Theodore Staging Area
	Orange Beach Staging Area
	Dauphin Staging Area
	Bayou LaBatre **Claims Office** 290 N. Wintzell Avenue Bayou LaBatre, AL 36509
	Foley **Claims Office** (Orange Beach/Gulf Shores/Bon Secour) 1506 North McKenzie Street (HWY 59), Suite 104 Foley, AL 36535
	Gulf Shores / Orange Beach **Claims Office** 24039 Perdido Beach Blvd Suite 1

	Orange Beach, AL 36561

ξ Community Outreach Centers now open in 2 counties.

ξ New Claims Office for Baldwin County opened at Orange Beach.

ξ Volunteer update includes 59 miles of beach cleaned up.

ξ Staffing claims centers with adjusters to process claims, looking at opening additional claims offices.

ξ Working with Vessels of Opportunity volunteers on training, and repaired deployed booms at three sites that were damaged by storm.

Florida Sites:	St. Petersburg Incident Command Post
	Pensacola Community Outreach Center, Staging Area
	Panama City Staging Area
	St. Joe Staging Area
	St. Marks Staging Area
	Ft. Walton **Claims Office** 348 SW Miracle Strip Pkwy Suite 13 Fort Walton Beach, FL 32548
	Gulf Breeze **Claims Office** 5668 Gulf Breeze Pkwy Unit B-9 Gulf Breeze, FL 32563
	Panama City **Claims Office** 7938 Front Beach Road Panama City Beach, FL 32408
	Pensacola **Claims Office** 3960 Navy Boulevard Suite 16-17

	Pensacola, FL 32507
	Port St. Joe **Claims Office** 106 Trade Circle Suite A Port St. Joe, FL 32456

- Community Outreach Centers are now open in 7 counties.
- New Claims Office for Gulf County opened at Port St. Joe.
- Volunteer update includes 130 miles of beach cleaned up.
- Holding town hall meetings with vessel owners and coordinating training for Vessels of Opportunity volunteers.
- Working with counties to review Area Contingency Plans and identify booming and beach clean up priorities.

Contact Information	
Environment / Community Hotline to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers to request volunteer information	(866) 448-5816
Services to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity to report and register boats available to assist with response	(281) 366-5511
Training for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit email suggestions to horizonresponse@piersystemcom	
Investor Relations	(281) 366-3123
Claims	(800) 440-0858
Joint Information Center Robert, LA Media and information center	(985) 902-5231 or (985) 902-5240
Joint Information Center Mobile, AL Media and information center	(251) 445-8965
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765

BP Family and third-party contractor hotline	(281) 366-5578
Twitter: Oil Spill 2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

BP America

Sr. Director, Regulatory Affairs

(202) 457-6594

(202) 351-1399 (cell)

stjohnk@bp.com

Received(Date): Wed, 19 May 2010 10:18:37 -0400
From: John Rapp <John.Rapp@noaa.gov>
Subject: Interagency Seafood Safety Call - Notes
To: "Sarri, Kristen" <KSarri@doc.gov>
Cc: _HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>,Monica Medina <Monica.Medina@noaa.gov>

Kris,
Here are a few points on what was discussed after you left the meeting. Please let me know if you have any questions.
Chris

Baseline data:

- Discussion focused on what efforts have been or are being used to collect baseline information. NOAA's Mussel Watch Program, vessel sampling by Federal and State agencies, and data collected post Katrina are among the efforts are being used. NMFS will send a paper that includes toxicity levels measured post Katrina to interested members on the call.

Dispersants:

- NOAA will be looking for dispersants in testing. EPA was asked to provide the chemical makeup of the dispersant as FDA and NOAA indicated that this is necessary for testing.
- Samples of the dispersant have been sent to NOAA labs.

Future sampling:

- Water sampling both on the surface and the subsurface should be used to inform fishing closures.
- NOAA is conducting waters samples as are the States

Toxicity levels:

- There will be a call today to discuss toxicity levels and appropriate contaminant exposures levels. OMB will set up this call. A time has not be set.

Received(Date): Wed, 19 May 2010 10:32:46 -0400
From: Christopher.Meaney@noaa.gov
Subject: Dispersant make-up
To: Lois.Schiffer@noaa.gov
Cc: Steve.Murawski@noaa.gov, Beth.Lumsden@noaa.gov, John.Rapp@noaa.gov

Lois,
Per your voice mail on a phone call to discuss the makeup of dispersants, I recommend that Steve Murawski be on the call. I also understand that Robert Haddad of OR&R should be included (rober.haddad@noaa.gov).

Chris

Lois,
Per your voice mail on a phone call to discuss the makeup of dispersants, I recommend that Steve Murawski be on the call. I also understand that Robert Haddad of OR&R should be included (rober.haddad@noaa.gov).

Chris

Received(Date): Wed, 19 May 2010 11:21:37 -0400
From: Jason Rolfe <Jason.Rolfe@noaa.gov>
Subject: NIC Request
To: _HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>,Dave Westerholm <Dave.Westerholm@noaa.gov>,William Conner <William.Conner@noaa.gov>,Roger L Parsons <Roger.L.Parsons@noaa.gov>,Robert Pavia <Robert.Pavia@noaa.gov>, Charlie Henry <Charlie.Henry@noaa.gov>,Demian Bailey <Demian.Bailey@noaa.gov>
Cc: Mark W Miller <Mark.W.Miller@noaa.gov>, ICC.HSPO@noaa.gov,ICC Deputy <ICC.Deputy@noaa.gov>

Mark Miller and I just met with CAPT Scott Beeson, NIC Situation Unit Chief of Staff. He's concerned that there is a large number of academic science vessels operating in the Gulf attempting to gather information on the existance/location of subsurface oil. The number of research vessels offering assistance will likely increase and as we understood it, their activities could impact response actions.

CAPT Beeson thought that Area Command might benefit from a single NOAA "Surface Platform Czar" who works with all vessels including these academic vessels to ensure their activities are known, the cruise results and data are made available to Unified Command/NOAA in a coordinated way; parallel position to NOAA CAPT Michelle Finn (Air Czar).

Charlie and Demian, we know you have been looking at this. Any luck in identifying someone? Can we here at the NIC help to find an appropriate NOAA person to help coordinate academic science vessels? Roger Parsons is on board as NIC Chief of Staff.

Second request - CAPT Beeson suggested that the NIC, NOAA and Coast Guard would benefit from a senior NOAA scientist who could be the single senior Science point of contact to the NIC. The issue was that there were some very complex issues that we are being pressed on that involves multiple agencies as well as varied academic connections - subsurface oil, loop current, dispersants, and This person would need to be conversant in NOAA science assets as well as broad agency and academic experience . He also requested that this person brief ADM Allen within the next day or so. We can work with CAPT Beeson on specific issues to be discussed.

Can the folks on this email at HCHB consider this single POC for NOAA science?

Received(Date): Wed, 19 May 2010 18:09:55 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: Atlantic Coast Governor's Call
To: dwh.staff@noaa.gov, 'John Gray' <John.Gray@noaa.gov>,'Monica Medina' <Monica.Medina@noaa.gov>,"'Jacqueline J. Rousseau'" <Jacqueline.J.Rousseau@noaa.gov>,Jen.Pizza@noaa.gov, "'Robert.Haddad'" <Robert.Haddad@noaa.gov>,Dave.Westerholm@noaa.gov, David.Kennedy@noaa.gov
Cc: "'Ramos, William'" <WRamos@doc.gov>

3:00pm

Agency Representatives:

Adm. Watson- NIC

Monica Medina and Bob Haddad- NOAA

John Perciasepe-EPA

Governors:

Crist- Florida

Sanford- South Carolina

Perdue – North Carolina

McDonald-Virginia

Adm. Watson: gave the NIC situation and leak stabilization report

Monica Medina gave an update on the oil's potential into the loop current

EPA Deputy Administrator Perciasepe gave a report on dispersants and toxicity

Questions:

Governor Crist: wanted clarification when there would be actual sighting on the Florida coast.

Answer: In 8-10 days.

Lisa Capone- Massachusetts Office of Energy (?)

Question: Do we expect the oil in New England?

Answer: No

Delaware Dept. of Natural Resources representative

Question: Wanted to know why we can't get a handle on how much oil is in the actual flow from the well?

Answer: -

Linda D. Belton

NOAA Office of Legislative and Intergovernmental Affairs

Phone: (202) 482-5447

Cell: (202) 302-7148

Fax: (202) 482-4960

email: linda.belton@noaa.gov

Received(Date): Thu, 20 May 2010 13:59:17 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update: May 19

Apologies for late arrival of this update for Wednesday, May 19.

Please let us know if you have questions.

Brian Miller and Chad Calvert

Gulf of Mexico Oil Spill Response Update

05/19/2010 – 9:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;

2. On the Surface to minimize impacts of the spill; and

3. Onshore to protect the shoreline and inform the public.

Highlights

- 19,403 personnel responding as part of the Unified Command, plus volunteers.
- Subsea dispersant application continues, 5,250 gallons injected on Tuesday.
- 218,000 gallons of oily water recovered and treated.
- New claims center opened in Florida.
- $4 million in additional claims paid since Monday.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

1. **Riser Insertion Tube** – The riser insertion tool was successfully placed into the leaking riser on Monday, and the tube is capturing approximately 3,000 barrels of oil per day. Crews on the surface are working to optimize recovery rates. This remains a new technology and both its continued operation and its effectiveness in capturing the oil and gas remain uncertain.

2. **Dispersant injection at the sea floor** – Dispersant application at the main leak continued on Tuesday with 5,250 gallons injected into the flow using Remote Operated Vehicles (ROVs). The dispersant acts by separating the oil into small droplets that can break down more easily through natural processes before it reaches the surface. Sonar testing and aerial photographs show encouraging results. Additional subsea applications are subject to ongoing testing protocols developed with the Environmental Protection Agency and other federal and state agencies.

3. **"Top Kill" Activities**

ξ Equipment is on location near the blowout preventer (BOP) to work on killing the well from the top. Manifold and bypass lines are connected to valves on the BOP. Through these valves, engineers will attempt first to pump heavy fluids and cement directly downhole to kill the well.

ξ The control "yellow pod" was deployed and riser connectors are on location and prepared for deployment.

ξ An additional option to control pressure is to inject a "junk shot" of shredded fibrous material into the BOP through these lines. The material will travel up the BOP and clog the flow of the well. Once the pressure is controlled, heavy fluids and cement can be pumped down the well to kill it.

ξ Diagnostics are ongoing. Gamma ray surveys have been completed to determine the status of internal components and pressures inside the blowout preventer.

4. **Drilling relief wells** – On Sunday, Transocean's drillship, *Development Driller II,* began drilling the second relief well. Like the first relief well, this one is approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. The first relief well was "spudded" by Transocean *Development Driller III* on Sunday, May 2, in a water depth of roughly 5,000 feet. This well has been drilled to 9,000 feet below sea level. It has been cased and cemented to that depth. Testing of the BOP is continuing and drilling should begin again within a couple of days. It is estimated the total drilling process will take at least 90 days. Once that is accomplished, and the original well has been penetrated, heavy fluids and cement can be pumped downhole to kill the well.

5. Containment Recovery System

ξ A containment dome, called a “top hat,” has been deployed to the sea floor and is readied to be placed over the main leak, if needed. It is designed with injection ports that can accommodate “anti-freeze” in order to mitigate the formation of large volumes of frozen hydrates.

ξ It is important to note that this technology has never been used at this water depth. Significant technical and operational challenges must be overcome for it to be successful.

Offshore – Surface Spill Response

ξ **Cleanup Vessels** – 932 specialty response vessels are now deployed, including tugs, barges andrecovery boats. 46 of the boats are skimmers, designed to separate oil from water. Approximately 187,476 barrels of oil-water mix (7.87 million gallons) have been recovered and treated.

ξ **Surface Dispersant** – 600,716 gallons of dispersant have been applied on the surface by aircraft, an increase of 11,709 gallons since Monday. The dispersant is a biodegradable chemical that works like soap by separating the oil into small droplets that can be more easily broken down by natural processes. An additional 320,000 gallons are available for deployment.

ξ **In-Situ Burning** – The Unified Command conducted 5 additional in-situ burns on Tuesday. The in-situ burning occurs on the surface using special fire-boom that collects surface hydrocarbons which are then burned off.

Onshore - Shoreline Protection and Community Outreach

ξ **BP Announces $70 million in Tourism Grants to States** – On Monday, BP CEO Tony Hayward announced the company will make an additional $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism. This money is in addition to the $100 million in block grants for accelerated implementation of Area Contingency Plans announced on May 4. It is also supplemental to BP’s private claims process, which remains unchanged

ξ **$25 Million Block Grants to 4 States** – On May 4, BP announced it would provide Louisiana, Florida, Mississippi and Alabama $25 million each to accelerate implementation of the States’ approved Area Contingency Plans. The Contingency Plans address removal of a worst case spill and are designed to mitigate or prevent a substantial threat to sensitive areas. The money will enable local businesses to immediately support clean-up and recovery efforts. The grant is supplemental to BP’s private claims

process, which remains unchanged.

- **Oil Containment and Shoreline Protection** – 1,925,000 feet of both sorbent and barrier boom have been deployed or staged to protect sensitive coastal areas. An additional 1,150,000 feet of boom is being directed to staging areas.

- **"Vessels of Opportunity" Program** – 4,581 contracts have been approved and 1,339 vessels are active and getting paid. Participating vessels are being organized into 25-boat task force teams to help with a variety of clean-up activities, including transporting supplies, performing wildlife rescue, and towing and deploying booms. To qualify for the program, operators need to meet several key requirements, including attending a four-hour hazardous waste training session, passing a dockside examination by the U.S. Coast Guard, and meeting crewing requirements based on the size of the vessel provided. 54 training sessions have been held across the four states. The contact number for people interested in registering for the program is (281) 366-5511 and information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers." For additional information about training call (866) 905-4492.

- **Volunteers and Training** – BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Training ramped up significantly this week, with sessions held at multiple locations across the Gulf. As of today, 13,339 volunteers have been trained in five different training modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

- **Informing Community Leaders** – The Unified Command continues to hold twice-daily teleconferences with mayors and community leaders across Mississippi, Alabama and Florida to ensure that elected officials have an opportunity to be updated on Command activities and to ask questions.

- **Wildlife Activities** – 2 additional reports of impacted wildlife were received, bringing the total to 38. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

- **Claims for Damages** - BP has opened 18 claims offices to help claimants through the process. Vietnamese and Spanish translators are in some offices. 19,000 claims have been filed and approximately $16 million has been paid out, an increase of $4 million since Monday. Most of the claims are for loss of income or wages in commercial fishing, shrimping and oyster harvest, and associated processing facilities. Note: No person asserting a claim or receiving payment for interim benefits will be asked or required to sign a release or waive any rights to assert additional claims, to file an individual legal action, or to participate in other legal actions associated with the Deepwater Horizon incident. The contact number for claims is (800) 440-0858. In person claims can be filed at office locations listed below. Claims can also be filed online at: http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138

Summary of Regional Operations and Outreach

Louisiana Sites:

Robert – Unified Area Command

Houma – Incident Command Post

Pointe A La Hache – Community Outreach Center

Venice – Community Outreach Center, Staging Area

Grand Isle – Staging Area

Port Fourchon – Staging Area

Cocodrie – Staging Area

Shell Beach – Staging Area

Slidell – Staging Area

St. Mary – Staging Area

Amelia – Staging Area

Belle Chasse – **Claims Office**

2766 Belle Chasse Hwy

Belle Chasse, LA 70037

Cut Off – **Claims Office**

Tarpon Heights Shopping Center

Unit 2

16263 E. Main Street

Cut Off, LA 70345

Grand Isle – **Claims Office**

3811 LA 1

Grand Isle, LA 70358

Hammond – **Claims Office**

Worley Operations Center

303 Timber Creek

Hammond, LA 70404

Houma – **Claims Office**

Plaza Caillou Shopping Center

814 Grand Caillou Road

Suite 2 & 3

Houma, LA 70363

Pointe A La Hache – **Claims Office**

	1553 Hwy 15 Pointe A La Hache, LA
	St. Bernard – **Claims Office** 1345 Bayou Rd Saint Bernard, LA 70085
	Venice – **Claims Office** 41093 Hwy LA 23 Boothville, LA 70038

- ξ Community Outreach Centers now open in 8 parishes.

- ξ Continuing to add adjusters to help process claims and working with translators to ensure that Vietnamese and Spanish speaking communities are served.

- ξ Working with the State to coordinate food stamp programs.

- ξ Working with Catholic Charities to deliver immediate community needs of food and clothing.

Mississippi Sites:	Pascagoula – Community Outreach Center, Staging Area
	Biloxi – Community Outreach Center, Staging Area
	Waveland – Community Outreach Center
	Pass Christian – Staging Area
	Bay St. Louis – **Claims Office** 1171 Highway 90 Bay St. Louis, MS 39520
	Biloxi – **Claims Office** 920 Cedar Lake Rd, Suite K Biloxi, MS 39532
	Pascagoula – **Claims Office** 5912 Old Mobile Hwy Suite 4 Pascagoula, MS 39563

ξ Community outreach centers are now open in all three coastal counties.

ξ Volunteer update includes 37 miles of beach cleaned up.

ξ Continuing to coordinate training for vessel operators and working on Vessels of Opportunity deployment.

Alabama Sites:	Mobile – Incident Command Post, Community Outreach Center
	Theodore – Staging Area
	Orange Beach – Staging Area
	Dauphin – Staging Area
	Bayou LaBatre – **Claims Office** 290 N. Wintzell Avenue Bayou LaBatre, AL 36509
	Foley – **Claims Office** (Orange Beach/Gulf Shores/Bon Secour) 1506 North McKenzie Street (HWY 59), Suite 104 Foley, AL 36535
	Gulf Shores / Orange Beach – **Claims Office** 24039 Perdido Beach Blvd Suite 1 Orange Beach, AL 36561

ξ Community Outreach Centers now open in 2 counties.

ξ Volunteer update includes 59 miles of beach cleaned up.

ξ Staffing claims centers with adjusters to process claims, looking at opening additional claims offices.

ξ Working with Vessels of Opportunity volunteers on training, and repaired deployed booms at three sites that were damaged by storm.

Florida Sites:	St. Petersburg – Incident Command Post
	Pensacola – Community Outreach Center, Staging Area
	Panama City – Staging Area
	St. Joe – Staging Area
	St. Marks – Staging Area
	Apalachicola – **Claims Office** 194 14th Street Suite 105 Apalachicola, FL 32320
	Ft. Walton – **Claims Office** 348 SW Miracle Strip Pkwy Suite 13 Fort Walton Beach, FL 32548
	Gulf Breeze – **Claims Office** 5668 Gulf Breeze Pkwy Unit B-9 Gulf Breeze, FL 32563
	Panama City – **Claims Office** 7938 Front Beach Road Panama City Beach, FL 32408
	Pensacola – **Claims Office** 3960 Navy Boulevard Suite 16-17 Pensacola, FL 32507
	Port St. Joe – **Claims Office** 106 Trade Circle

	Suite A Port St. Joe, FL 32456

ξ Community Outreach Centers are now open in 7 counties.

ξ New Claims Office for Franklin County opened at Apalachicola.

ξ Volunteer update includes 130 miles of beach cleaned up.

ξ Holding town hall meetings with vessel owners and coordinating training for Vessels of Opportunity volunteers.

ξ Working with counties to review Area Contingency Plans and identify booming and beach clean up priorities.

Contact Information	
Environment / Community Hotline – to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife – to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers – to request volunteer information	(866) 448-5816
Services – to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity – to report and register boats available to assist with response	(281) 366-5511
Training – for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit – email suggestions to horizonresponse@piersystemcom	
Investor Relations	(281) 366-3123
Claims – by phone	(800) 440-0858
Claims – http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138	
Joint Information Center – Robert, LA – Media and information center	(985) 902-5231 or (985) 902-5240
Joint Information Center – Mobile, AL – Media and information center	(251) 445-8965
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765
BP Family – and third-party contractor hotline	(281) 366-5578
Twitter: Oil_Spill_2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

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stjohnk@bp.com

Received(Date): Thu, 20 May 2010 19:15:21 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: FW: Pre-brief at 9:05 on Friday
To: dwh.staff@noaa.gov, 'John Gray' <John.Gray@noaa.gov>,Dave.Westerholm@noaa.gov, David.Kennedy@noaa.gov, Jen.Pizza@noaa.gov

As noted, John Gray has again agreed to do the calls in the morning. Again, it is requested if Dave Westerholm, or one of his staff, could talk about the loop current.

Beth, I will let you know tomorrow who will do the calls Saturday, Sunday and Monday.

From: McGrath, Shaun L. [mailto:Shaun L. McGrath@who.eop.gov]
Sent: Thursday, May 20, 2010 4:26 PM
To: McGrath, Shaun L.; Belton, Linda; Monica Medina; heather.smith1@dhs.gov; Tennyson, Stephanie L; Pallone.Sarah@epamail.epa.gov; Lori Faeth; Kayyem, Juliette; Murk, David CDR
Subject: Pre brief at 9:05 on Friday

All,

Draft agenda for the call tomorrow is below. Please let me know if there are any changes.

Friday, May 21 Call with Governors

9:05 a.m. pre-brief; 9:15 Governors

[redacted] b6

[redacted] b6 – **Speakers**

Please limit participation in the pre-conference to speakers and essential staff.

DRAFT AGENDA

-

· Opening remarks (Valerie Jarrett)

- Observations and Trajectory – **John Gray, NOAA**

o NOAA will provide the latest observations and trajectories

o Loop Current

o Barbour – how close does the loop current get to the Gulf Coast? (have we sent out pictures of the loop current trajectories?)

o Jindal – what is the form of the oil as it moves West? How far inland will it move?

- Situation and Leak Stabilization Update – **RADM Peter Neffenger, NIC**

o Latest information from National Incident Command, including current status of efforts to stabilize the leaks.

- Operations Report – **RADM Mary Landry, UAC**

o Response Plans and Boom

o Jindal – have we confirmed the oil in Marsh Is. is BP? (Landry – we will get you that answer)

o Jindal – pay particularly close attention to Terrebonne and Timbalier Bay

o Jindal – Again urged approval of the barrier. Neffenger said that Adm Allen is trying to schedule a call with him today. (We need to circulate the latest talking points, and be prepared on messaging after that conversation.)

- EPA Update – **EPA Dep Admin BobPerciasepe**

o Barbour – If data is showing that the current dispersant is effective, why are we changing it?

- Wildlife Impacts – **Eileen Sobeck, FWS**

- Marine Wildlife Impacts and Fisheries Closures **– John Gray, NOAA**

- Open discussion and Q&A with Governors and state officials

- Next call – 9:15 a.m. EDT (8:15 CDT) Saturday, May 22, 2010

Received(Date): Fri, 21 May 2010 13:33:42 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update

BP issued the following press release this morning regarding live feed of the riser leak source. I also attach last night's update.

Please let me know if you have questions, Karen.

BP Press Release

May 21, 2010

BP LAUNCHES LIVE WEBCAM OF RISER FLOW

Today BP launched a live webcam of the riser flow. The webcam can be viewed at www.bp.com.

BP has been providing a live feed to government entities over the last two weeks – including the US Department of the Interior, US Coast Guard, Minerals Management Service (MMS) through the Unified Area Command center in Louisiana – as well as to BP and industry scientists and engineers involved in the effort to stop the spill.

BP continues its work to collect oil by the riser insertion tube tool (RITT) containment system. Once on the drillship Discoverer Enterprise, the oil is then being stored and gas is being flared. The RITT remains a new technology and both its continued operation and its effectiveness in capturing the oil and gas remain uncertain.

BP has, and will continue, to support the government's work to determine the rate of flow from the well. Since the Deepwater Horizon accident, the flow rate estimate has been established by the Unified Command. Throughout the process, BP has made it a priority to quickly and consistently provide the National Oceanic and Atmospheric Administration (NOAA) and the Coast Guard with requested information for the joint command structure to make as accurate an assessment as possible of the rate of flow.

The rate of flow from the riser is determined in a number of ways and by a number of variables. For instance, while the original riser was 19.5 inches in diameter prior to the Deepwater Horizon accident, damage sustained during the accident distorted the diameter at the end of the pipe by about 30 per cent. In addition, a drill pipe currently trapped inside the riser has reduced the flow area by an additional 10 per cent. Thus, some third party estimates of flow, which assume a 19.5 inch diameter, are inaccurate. As well, there is natural gas in the riser. Data on the hydrocarbons recovered to date suggests that the proportion of gas in the plume exiting the riser is, on average, approximately 50 percent.

To provide further specificity on the flow rate, the US government has created a Flow Rate Technical Team (FRTT) to develop a more precise estimate. The FRTT includes the US Coast Guard, NOAA, MMS, Department of Energy (DOE) and the US Geological Survey. The FRTT is mandated to produce a report by close of business on Saturday, May 22.

To support this, BP is in the process of providing FRTT with all requested information, including diagrams and schematics showing release points, amounts of oil and gas currently being collected on the Discoverer Enterprise, and subsea video of the oil release point.

BP Press Office London: +44 20 7496 4076

BP Press office, US: +1 281 366 0265

Unified Command Joint Information Center:+1 985-902-5231

www.deepwaterhorizonresponse.com

www.bp.com/gulfofmexicoresponse

Gulf of Mexico Oil Spill Response Update

05/20/2010 – 8:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;
2. On the Surface to minimize impacts of the spill; and
3. Onshore to protect the shoreline and inform the public.

Highlights

- 24,759 personnel responding as part of the Unified Command, plus volunteers, an increase of more than 5,000 since Tuesday.
- Riser Insertion Tube continues to capture oil and natural gas from the primary leak.
- 50 additional specialty cleanup vessels were deployed on Thursday.
- Subsea dispersant application continued, 3,463 gallons injected Wednesday.
- 497,000 gallons of oily water recovered and treated since Tuesday.
- $4 million in additional claims paid on Wednesday.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

1. **Riser Insertion Tube** – The riser insertion tool was successfully placed into the leaking riser on Monday, and is consistency capturing oil and natural gas. Crews on the surface continue to work to optimize recovery rates. This remains a new technology and both its continued operation and its effectiveness in capturing the oil and gas remain uncertain.

2. **Dispersant injection at the sea floor** – Dispersant application at the main leak continued on Tuesday with 3,463 gallons injected into the flow using Remote Operated Vehicles (ROVs). The dispersant acts by separating the oil into small droplets that can break down more easily through natural processes before it reaches the surface. Sonar testing and aerial photographs show encouraging results. Additional subsea applications are subject to ongoing testing protocols developed with the Environmental Protection Agency and other federal and state agencies.

3. **"Top Kill" Activities**

ξ Equipment is on location near the blowout preventer (BOP) to work on killing the well from the top. Manifold and bypass lines are connected to valves on the BOP. Through these valves, engineers will attempt first to pump heavy fluids and cement directly downhole to kill the well.

ξ The control "yellow pod" was deployed and riser connectors are on location and being connected. Engineers will pressure test the system and are prepared to make a first attempt to top kill the well sometime this weekend.

ξ An additional option to control pressure is to inject a "junk shot" of shredded fibrous material into the BOP through these lines. The material will travel up the BOP and clog the flow of the well. Once the pressure is controlled, heavy fluids and cement can be pumped down the well to kill it.

ξ Diagnostics are ongoing. Gamma ray surveys have been completed to determine the status of internal components and pressures inside the blowout preventer.

4. **Drilling relief wells** – On Sunday, Transocean's drillship, *Development Driller II,* began drilling the second relief well. Like the first relief well, this one is approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. The first relief well was "spudded" by Transocean *Development Driller III* on Sunday, May 2, in a water depth of roughly 5,000 feet. This well has been drilled to 9,000 feet below sea level. It has been cased and cemented to that depth. Testing of the BOP is complete and drilling began again on Thursday. It is estimated the total drilling process will take at least 90 days. Once that is accomplished, and the original well has been penetrated, heavy fluids and cement can be pumped downhole to kill the well.

5. **Containment Recovery System**

ξ A containment dome, called a "top hat," has been deployed to the sea floor and is readied to be

placed over the main leak, if needed. It is designed with injection ports that can accommodate "anti-freeze" in order to mitigate the formation of large volumes of frozen hydrates.

- It is important to note that this technology has never been used at this water depth. Significant technical and operational challenges must be overcome for it to be successful.

Offshore – Surface Spill Response

- **Cleanup Vessels** – 988 specialty response vessels are now deployed, including tugs, barges andrecovery boats. 54 of the boats are skimmers, designed to separate oil from water. Approximately 199,325 barrels of oil-water mix (8.37 million gallons) have been recovered and treated, an increase of nearly 500,000 gallons.

- **Surface Dispersant** – 604,066 gallons of dispersant have been applied on the surface by aircraft, an increase of 3,350 gallons since Tuesday. The dispersant is a biodegradable chemical that works like soap by separating the oil into small droplets that can be more easily broken down by natural processes. An additional 346,000 gallons are available for deployment. BP is working with the EPA to identify alternative effective dispersants for deployment.

- **In-Situ Burning** – The Unified Command conducted an additional 6 in-situ burns on Wednesday. The in-situ burning occurs on the surface using special fire-boom that collects surface hydrocarbons which are then burned off.

Onshore - Shoreline Protection and Community Outreach

- **BP Provides $70 million in Tourism Grants to States** – On Monday, BP made $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism. This money is in addition to the $100 million in block grants for accelerated implementation of Area Contingency Plans announced on May 4. <u>It is also supplemental to BP's private claims process, which remains unchanged</u>

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ξ **Oil Containment and Shoreline Protection** – 1,925,000 feet of both sorbent and barrier boom have been deployed or staged to protect sensitive coastal areas. An additional 1,150,000 feet of boom is being directed to staging areas.

ξ **"Vessels of Opportunity" Program** – Nearly 5,000 contracts have been approved and 1,340 vessels are active and getting paid.

ξ **Volunteers and Training** – BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Volunteers are being trained in five different modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

ξ **Informing Community Leaders** – The Unified Command continues to hold twice-daily teleconferences with mayors and community leaders across Mississippi, Alabama and Florida to ensure that elected officials have an opportunity to be updated on Command activities and to ask questions.

ξ **Wildlife Activities** – 13 additional reports of impacted wildlife were received, bringing the total to 51. One turtle has been recovered and cleaned that was affected by oil. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

ξ **Claims for Damages** - BP has opened 18 claims offices to help claimants through the process. Vietnamese and Spanish translators are in some offices. 20,000 claims have been filed and more than 9,000 paid, totalling approximately $20 million, an increase of $4 million since Tuesday. Most of the claims are for loss of income or wages in commercial fishing, shrimping and oyster harvest, and associated processing facilities. <u>Note: No person asserting a claim or receiving payment for interim benefits will be asked or required to sign a release or waive any rights to assert additional claims, to file an individual legal action, or to participate in other legal actions associated with the Deepwater Horizon incident.</u> The contact number for claims is (800) 440-0858. In person claims can be filed at office locations listed below. Claims can also be filed online at: http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138

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ξ Community outreach centers are now open in all three coastal counties.

ξ Volunteer update includes 37 miles of beach cleaned up.

ξ Continuing to coordinate training for vessel operators and working on Vessels of Opportunity deployment.

ξ Opened a new community outreach office in Gulfport to serve Harrison County.

Alabama Sites:	Mobile – Incident Command Post, Community Outreach Center
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	Dauphin – Staging Area
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- Community Outreach Centers now open in 2 counties.
- Volunteer update includes 59 miles of beach cleaned up.
- Staffing claims centers with adjusters to process claims, looking at opening additional claims offices.
- New training for shoreline protection organized in Mobile and Robertsdale.

Florida Sites:	St. Petersburg – Incident Command Post
	Pensacola – Community Outreach Center, Staging Area
	Panama City – Staging Area
	St. Joe – Staging Area
	St. Marks – Staging Area
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Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

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stjohnk@bp.com

Received(Date): Fri, 21 May 2010 11:12:46 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: Notes from Governors Call May 21
To: dwh.staff@noaa.gov, 'John Gray' <John.Gray@noaa.gov>,Dave.Westerholm@noaa.gov, David.Kennedy@noaa.gov,'Monica Medina' <Monica.Medina@noaa.gov>,'Amanda Hallberg' <Amanda.Hallberg@noaa.gov>,'Margaret Spring' <Margaret.Spring@noaa.gov>, Jen.Pizza@noaa.gov,"'Jacqueline J. Rousseau'" <Jacqueline.J.Rousseau@noaa.gov>,'John Oliver' <John.Oliver@noaa.gov>

Moderator: Valerie Jarrett

Governors: Jindal

· **David Westerholm mentioned that the crab traps were neg on subsurface oil. (Action item: are these results available to give to the Governor's and local officials?)**

· **Gov. Jindal asked about how far we can expect the oil to move west. Westerholm said that currents are keeping it east of Atchafalya and do not see anything to keep it further west – that will depend on the winds.**

· Adm. Neffenger – top kill commences on May 25; will take 2-3 days.

· Adm. Neffenger – also reported on the establishment of a team to determine the flow rate. Will be an independent, peer-reviewed study to determine following:

o Actual daily flow

o Looking at plume and where it goes

o Total volume released

o Total reservoir capacity (long-term implications – how long can this flow if not capped?) this is important for claims

We will let Govs know as soon as we have the findings.

· Adm. Landry – we will keep Gov apprised of the impacts of oil on shoreline we can expect (when, where and type of oil) based on our trajectories

· Adm. Landry – we put pressure on BP to increase the focus on Terrebonne; Landry – hopefully we will see today whether we are successful in mitigating the oil's movement into the marshes

· Adm. Landry – employing more fishermen. Said Gov would hopefully see that today on his flight. Said to let us know if not seeing it.

· Gov. Jindal – what is flow out ofinsertion tube – 2200 or 5000 barrels per day. When will there be a better quantification of much is actually being released? There is a mixture of liquefied gas and oil.

· Gov. Jindal – are we changing subsea dispersant? EPA – continuing to monitor dispersant toxicity

· Gov. Jindal – thanks for talking to BP. We need more boom and also someone there to release the boom already stockpiled

Linda D. Belton

NOAA Office of Legislative and Intergovernmental Affairs

Phone: (202) 482-5447

Cell: (202) 302-7148

Fax: (202) 482-4960

email: linda.belton@noaa.gov

Received(Date): Fri, 21 May 2010 14:33:16 -0400
From: John Rapp <John.Rapp@noaa.gov>
Subject: Bullets on the Gunter cruise
To: Justin Kenney <Justin.kenney@noaa.gov>,Scott Smullen <Scott.Smullen@noaa.gov>,Jennifer Austin <Jennifer.Austin@noaa.gov>
Cc: Jessica Kondel <Jessica.Kondel@noaa.gov>,Samuel Rauch <Samuel.Rauch@noaa.gov>, John Oliver <John.Oliver@noaa.gov>,Eric Schwaab <Eric.Schwaab@noaa.gov>,'Steve Murawski' <Steve.Murawski@noaa.gov>,Jenni Wallace <Jenni.Wallace@noaa.gov>,Brian Pawlak <Brian.T.Pawlak@noaa.gov>,Lauren B Lugo <Lauren.B.Lugo@noaa.gov>,Rebecca Chiampi <Rebecca.Chiampi@noaa.gov>,Gloria Thompson <Gloria.Thompson@noaa.gov>,_HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>,Christopher Meaney <Christopher.Meaney@noaa.gov>

Justin, Scott, and Jen:

Talking points on the Gunter and Weatherbird cruises were requested on this mornings 8am call. The points below have been cleared by Steve Murawski (NMFS) and are ready for your review and clearance (should you feel that's necessary).

- Knowledge of the extent and density of subsurface plumes is vital to NOAA's response activities including development of fishery closures, rescue of marine wildlife, and protection of human health.
- The R/V Gordon Gunter and R/V Weatherbird II will embark on a cruise to map the 3 dimensional structure of the "plume" of sub surface oil and dispersants. Scientists on the vessels will also characterize the rates and directions of flows including the possibility of entrainment into the "Loop Current".
- An additional component of the cruises is the sampling of sub surface biological communities. This information will help NOAA and its partners understand the potential impacts of sub surface oil and dispersants on affected ecosystems.
- The R/V Gordon Gunter and R/V Weatherbird II will embark on a 7-day proof-of-concept study. Should the technology prove effective, the effort could be expanded to more vessels and for increased durations.
- There is great interest in verifying the hypothesis that layers of oil, or plumes, exist at depth in the Gulf of Mexico. Should they be present, more questions about the nature and extent of the layers exist. This partnership among federal, academic and industry employs several technologies to address these questions.

John

Received(Date): Fri, 21 May 2010 15:22:12 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: FW: Pre-brief at 9:05 on Saturday
To: dwh.staff@noaa.gov, 'John Gray' <John.Gray@noaa.gov>,David.Kennedy@noaa.gov, Dave.Westerholm@noaa.gov,'Monica Medina' <Monica.Medina@noaa.gov>,'Margaret Spring' <Margaret.Spring@noaa.gov>
Cc: "'Jacqueline J. Rousseau'" <Jacqueline.J.Rousseau@noaa.gov>,Jen.Pizza@noaa.gov, 'John Oliver' <John.Oliver@noaa.gov>,Adele.Stevens@noaa.gov

· Beth, John Gray will do the Governor's calls on Saturday and Sunday; with David Kennedy.

· I believe Monica will be back on Monday. Monica please let me know if this is not correct.

· You will notice that fishery closure and wildlife impacts report have been removed from the agenda; we do not have to report on this unless there is a significant change or request.

From: McGrath, Shaun L. [mailto:Shaun L. McGrath@who.eop.gov]
Sent: Friday, May 21, 2010 12:27 PM
To: McGrath, Shaun L.; Belton, Linda; Monica Medina; heather.smith1@dhs.gov; Tennyson, Stephanie L; Pallone.Sarah@epamail.epa.gov; Lori Faeth; Kayyem, Juliette; Murk, David CDR
Subject: Pre brief at 9:05 on Saturday

All,

Draft agenda for the call tomorrow is below. Please let me know if there are any changes.

Saturday, May 22 Call with Governors

9:05 a.m. pre-brief; 9:15 Governors

[redacted]

[redacted] - **Speakers**

[Guest Pin: [redacted]

Please limit participation in the pre-conference to speakers and essential staff.

DRAFT AGENDA

· Opening remarks (Valerie Jarrett)

· Observations and Trajectory – **John Gray and David Kennedy, NOAA**

o NOAA will provide the latest observations and trajectories

o Loop Current

o David Westerholm mentioned that the crab traps were neg on subsurface oil. We need a report out on the findings from all of the crab trap tests.

o Jindal asked about how far we can expect the oil to move West.

· Situation and Leak Stabilization Update – **RADM Peter Neffenger, NIC**

o Latest information from National Incident Command, including current status of efforts to stabilize the leaks.

o Neffenger – top kill commences on May 25; will take 2-3 days

o Neffenger – have established a team to determine the flow rate. Will be an independent, peer-reviewed study to determine actual daily flow, plume movement, total volume, and total reservoir capacity. We will let Govs know as soon as we have the findings.

o Jindal – what is flow out of insertion tube – 2200 or 5000 barrels per day

o Jindal – Urged decision on the barrier proposal. Mentioned that he will talk to Adm Allen at 10:00 today (NOTE: that is the wrong time)

· Operations Report – **RADM Mary Landry, UAC**

o Response Plans and Boom

o Landry – we will keep Gov apprised of the impacts he can expect (when, where and type of oil) based on our trajectories

o Landry – we put pressure on BP to increase the focus on Terrebonne. We will see today

whether BP follows.

o Landry – hopefully we will see today whether we are successful in mitigating the oil's movement into the marshes

o Landry – employing more fisherman. Said Gov would hopefully see that today on his flight. Said to let us know if not seeing it.

o Jindal – thanks for talking to BP. We need more boom and also someone there to release the boom already stockpiled

· EPA Update – **EPA Dep Admin BobPerciasepe**

o Jindal – are we changing subsea dispersant?

· Open discussion and Q&A with Governors and state officials

· Next call – 9:15 a.m. EDT (8:15 CDT) Sunday, May 23, 2010

-

Received(Date): Fri, 21 May 2010 16:40:29 -0400
From: David Holst <David.Holst@noaa.gov>
Subject: DOC meeting
To: Jainey Bavishi <Jainey.Bavishi@noaa.gov>, John Rapp <John.Rapp@noaa.gov>

Jainey and John,

Some items to mention at the DOC Coordination meeting. Not sure if you were on the Science summit call today, but below are some highlights.

Flow Rate

- Flow Rate Technical Group received new ROV video from BP Thursday evening. The videos are specific to April 30, May 1, May 2. These videos will be used by the Plume Analysis Team to produce a revised estimate of flow rate. They are planning to have a flow rate by this weekend (maybe early next week).

- The collection rate of 5,000 barrels reported yesterday was an instantaneous rate, not a per day output. A constant (per day) collection rate of 2,200 barrels is considered to be more accurate.

Science Summit

- Gabriele has put together a paper that describes this. Key points:
    - will take place in two weeks in LA;
    - COL and UH will organize it;
    - Will consist of the smaller dispersants workshop followed by the larger one-day science summit the following day;
    - 1/2 day of fed presentations on current status and science, followed by 1/2 day of breakouts focused on specific issues
    - Dr. L will be discussing with principals this weekend. Likely announced next week.
    - Justin is working the communication side.

Received(Date): Fri, 21 May 2010 17:50:13 -0400
From: John Rapp <John.Rapp@noaa.gov>
Subject: [Fwd: Bullets on the Gunter cruise]
To: "Reich, Jay" <JReich@doc.gov>, "Sarri, Kristen" <KSarri@doc.gov>
Cc: Margaret Spring <Margaret.Spring@noaa.gov>,Monica Medina <Monica.Medina@noaa.gov>, Sally Yozell <Sally.Yozell@noaa.gov>,_HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>

Jay,

Per your request during the DOC/NOAA Coordination meeting, I'm sending you information for Secretary Locke's situational awareness regarding the Gunter and Weatherbird cruises. This information has not been cleared by the White House and is only meant for internal use.

John

-------- Original Message --------

Subject: Bullets on the Gunter cruise
Date: Fri, 21 May 2010 14:33:16 -0400
From: John Rapp <John.Rapp@noaa.gov>
To: Justin Kenney <Justin.kenney@noaa.gov>, Scott Smullen <Scott.Smullen@noaa.gov>, Jennifer Austin <Jennifer.Austin@noaa.gov>
CC: Jessica Kondel <Jessica.Kondel@noaa.gov>, Samuel Rauch <Samuel.Rauch@noaa.gov>, John Oliver <John.Oliver@noaa.gov>, Eric Schwaab <Eric.Schwaab@noaa.gov>, 'Steve Murawski' <Steve.Murawski@noaa.gov>, Jenni Wallace <Jenni.Wallace@noaa.gov>, Brian Pawlak <Brian.T.Pawlak@noaa.gov>, Lauren B Lugo <Lauren.B.Lugo@noaa.gov>, Rebecca Chiampi <Rebecca.Chiampi@noaa.gov>, Gloria Thompson <Gloria.Thompson@noaa.gov>, HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>, Christopher Meaney <Christopher.Meaney@noaa.gov>

Justin, Scott, and Jen:

Talking points on the Gunter and Weatherbird cruises were requested on this mornings 8am call. The points below have been cleared by Steve Murawski (NMFS) and are ready for your review and clearance (should you feel that's necessary).

- Knowledge of the extent and density of subsurface plumes is vital to NOAA's response activities including development of fishery closures, rescue of marine wildlife, and protection of human health.
- The R/V Gordon Gunter and R/V Weatherbird II will embark on a cruise to map the 3 dimensional structure of the "plume" of sub surface oil and dispersants. Scientists on the

vessels will also characterize the rates and directions of flows including the possibility of entrainment into the “Loop Current”.

- An additional component of the cruises is the sampling of sub surface biological communities. This information will help NOAA and its partners understand the potential impacts of sub surface oil and dispersants on affected ecosystems.
- The R/V Gordon Gunter and R/V Weatherbird II will embark on a 7-day proof-of-concept study. Should the technology prove effective, the effort could be expanded to more vessels and for increased durations.
- There is great interest in verifying the hypothesis that layers of oil, or plumes, exist at depth in the Gulf of Mexico. Should they be present, more questions about the nature and extent of the layers exist. This partnership among federal, academic and industry employs several technologies to address these questions.

John

Received(Date): Fri, 21 May 2010 18:31:34 -0400
From: "Jainey.Bavishi" <Jainey.Bavishi@noaa.gov>
Subject: Fishermen getting sick from dispersants
To: "'jennifer.austin@noaa.gov'" <Jennifer.Austin@noaa.gov>,"'scott.smullen@noaa.gov'" <Scott.Smullen@noaa.gov>,"'dwh.staff@noaa.gov'" <dwh.staff@noaa.gov>

Scott and Jen,

At the DOC Coordination Meeting today, Jen Costanza mentioned that she saw a headline on CNN that read "Fishermen getting sick from dispersants." She was wondering if we had received any press inquiries on this. Could you let me know so that I can get back to her?

Thanks!
Jainey

Received(Date): Sat, 22 May 2010 01:39:33 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update: May 21, 2010

Gulf of Mexico Oil Spill Response Update

05/21/2010 – 5:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;

2. On the Surface to minimize impacts of the spill; and

3. Onshore to protect the shoreline and inform the public.

Highlights

- 23,997 personnel responding as part of the Unified Command, plus volunteers.
- 100 additional specialty cleanup vessels deployed, 1,085 vessels active.
- Subsea dispersant application is ongoing, 14,210 gallons injected Thursday.
- 571,000 gallons of additional oily water recovered and treated on Thursday.
- Nearly $5 million in additional claims paid on Thursday.
- Drilling of relief wells continues.
- Live video link from the ROV monitoring the damaged riser
  - www.bp.com
  - http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/homepage/STAGING/local_assets/bp_homepage/html/rov_stream.html

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

1. **Riser Insertion Tube** – The riser insertion tool was successfully placed into the leaking riser on Monday. Over the last twenty-four hours it collected approximately 2,200 barrels of oil and 15 million standard cubic feet of natural gas. Crews on the surface continue to work to optimize recovery rates. This remains a new technology and both its continued operation and its effectiveness in capturing the oil and gas remain uncertain.

2. **Dispersant injection at the sea floor** – Dispersant application at the main leak continued on Thursday with 14,210 gallons injected into the flow using Remote Operated Vehicles (ROVs). The dispersant acts by separating the oil into small droplets that can break down more easily through natural processes before it reaches the surface. Sonar testing and aerial photographs show encouraging results.

3. **"Top Kill" Activities**

ξ The manifold and bypass lines are connected to valves on the blowout preventer (BOP). Through these valves, engineers will attempt first to pump heavy fluids and cement directly downhole to kill the well.

ξ The control "yellow pod" was deployed and riser connectors are on location and being connected. Engineers will pressure test the system and are prepared to make a first attempt to top kill the well sometime in the next few days.

ξ An additional option to control pressure is to inject a "junk shot" of shredded fibrous material into the BOP through these lines. The material will travel up the BOP and clog the flow of the well. Once the pressure is controlled, heavy fluids and cement can be pumped down the well to kill it.

4. **Drilling relief wells** – Drilling of both relief wells is proceeding.

ξ The first relief well (work being performed by the Development Driller III) is at approximately 10,000 feet below sea level.

ξ The second relief well (work being performed by Development Driller II) is at approximately 6,800 feet below sea level.

ξ Both wells are situated approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. It is estimated the total drilling process for each well will take at least 90 days. Once that is accomplished, and the original well has been penetrated, heavy fluids and cement can be pumped downhole to kill the well.

5. **Containment Recovery System**

ξ A containment dome, called a "top hat," is deployed on the sea floor and readied to be placed over the main leak, if needed. It is designed with injection ports that can accommodate "anti-freeze" in order to mitigate the formation of large volumes of frozen hydrates. This technology has never been used at this water depth. Significant technical and operational challenges must be overcome for it to be

successful.

Offshore – Surface Spill Response

- **Cleanup Vessels** – 1,085 specialty response vessels are now deployed, including tugs, barges and recovery boats. 56 of the boats are skimmers, designed to separate oil from water.

- **Skimming** – On Thursday, approximately 13,600 barrels (571,000 gallons) of oil-water mix were recovered. To date, approximately 213,000 barrels of oil-water mix (8.95 million gallons) have been recovered and treated.

- **Surface Dispersant** – 604,066 gallons of dispersant have been applied on the surface by aircraft. The dispersant is a biodegradable chemical that works like soap by separating the oil into small droplets that can be more easily broken down by natural processes. An additional 348,000 gallons are available for deployment. BP is working with the Environmental Protection Agency to identify alternative effective dispersants for deployment.

- **In-Situ Burning** – The Unified Command conducted an additional 6 in-situ burns on Thursday. The in-situ burning occurs on the surface using special fire-boom that collects surface hydrocarbons which are then burned off. Note: approximately 23,000 barrels of oil were burned on Wednesday.

Onshore - Shoreline Protection and Community Outreach

- **Oil Containment and Shoreline Protection** – No new locations for oil ashore reported in the last 24 hours. A total of 2,030,000 feet of both sorbent and barrier boom have been deployed or staged to protect sensitive coastal areas. This is an increase of 100,000 feet since Wednesday.

- **Wildlife Activities** – No additional reports of impacted wildlife were received in the past 24 hours. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

- **Claims for Damages** - BP has opened 18 claims offices to help claimants through the process. Vietnamese and Spanish translators are in some offices. 21,540 claims have been filed and nearly $25 million has been paid, an increase of $5 million since Wednesday. Most of the claims are for loss of income or wages in commercial fishing, shrimping and oyster harvest, and associated processing facilities. <u>Note: No person asserting a claim or receiving payment for interim benefits will be asked or required to sign a release or waive any rights to assert additional claims, to file an individual legal action, or to participate in other legal actions associated with the Deepwater Horizon incident.</u> The contact number for claims is (800) 440-0858. In person claims can be filed at office locations listed below. Claims can also be filed online at:

http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138

ξ **BP Provides $70 million in Tourism Grants to States** – On Monday, BP CEO Tony Hayward made $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism. This money is in addition to the $100 million in block grants for accelerated implementation of Area Contingency Plans announced on May 4. It is also supplemental to BP's private claims process, which remains unchanged.

ξ **$25 Million Block Grants to 4 States** – On May 4, BP announced it would provide Louisiana, Florida, Mississippi and Alabama $25 million each to accelerate implementation of the States' approved Area Contingency Plans. The Contingency Plans address removal of a worst case spill and are designed to mitigate or prevent a substantial threat to sensitive areas. The money is supporting businesses in clean-up and recovery efforts. The grant is supplemental to BP's private claims process, which remains unchanged.

ξ **"Vessels of Opportunity" Program**– Nearly 5,000 contracts have been approved and 1,100 vessels are currently active.

To qualify for the program, operators need to meet several key requirements, including attending a four-hour hazardous waste training session, passing a dockside examination by the U.S. Coast Guard, and meeting crewing requirements based on the size of the vessel provided. The contact number for people interested in registering for the program is (281) 366-5511 and information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers." For additional information about training call (866) 905-4492.

ξ **Volunteers and Training** – BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Volunteers are being trained in five different modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. As of Thursday, 13,514 individual training modules had been completed. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

Summary of Regional Operations and Outreach			
Louisiana Sites:	Robert – Unified Area Command		
		Houma – Incident Command Post	
			Pointe A La Hache – Community Outreach Center
			Venice – Community Outreach Center, Staging Area
			Grand Isle – Staging Area
			Port Fourchon – Staging Area
			Cocodrie – Staging Area

Shell Beach – Staging Area		
	Slidell – Staging Area	
	St. Mary – Staging Area	
	Amelia – Staging Area	
	Belle Chasse – **Claims Office** 2766 Belle Chasse Hwy Belle Chasse, LA 70037	
	Cut Off – **Claims Office** Tarpon Heights Shopping Center Unit 2 16263 E. Main Street Cut Off, LA 70345	
	Grand Isle – **Claims Office** 3811 LA 1 Grand Isle, LA 70358	
	Hammond – **Claims Office** Worley Operations Center 303 Timber Creek Hammond, LA 70404	
	Houma – **Claims Office** Plaza Caillou Shopping Center 814 Grand Caillou Road Suite 2 & 3 Houma, LA 70363	
	Pointe A La Hache – **Claims Office** 1553 Hwy 15 Pointe A La Hache, LA	
	St. Bernard – **Claims Office** 1345 Bayou Rd Saint Bernard, LA 70085	
	Venice – **Claims Office**	

	41093 Hwy LA 23 Boothville, LA 70038

ξ Community Outreach Centers now open in 8 parishes.

ξ BP donated $1 million and is working with Catholic Charities and Second Harvest Food Bank in St. Bernard, Plaquemines and Orleans Parishes to deliver humanitarian assistance.

ξ Continuing to add adjusters to help process claims and working with translators to ensure that Vietnamese and Spanish speaking communities are served.

Mississippi Sites:	Pascagoula – Community Outreach Center, Staging Area
	Biloxi – Community Outreach Center, Staging Area
	Waveland – Community Outreach Center
	Pass Christian – Staging Area
	Bay St. Louis – **Claims Office** 1171 Highway 90 Bay St. Louis, MS 39520
	Biloxi – **Claims Office** 920 Cedar Lake Rd, Suite K Biloxi, MS 39532
	Pascagoula – **Claims Office** 5912 Old Mobile Hwy Suite 4 Pascagoula, MS 39563

ξ Community outreach centers are now open in all three coastal counties.

ξ Volunteer update includes 37 miles of beach cleaned up.

ξ Continuing to coordinate training for vessel operators and working on Vessels of Opportunity deployment.

Alabama Sites:	Mobile – Incident Command Post, Community Outreach Center
	Theodore – Staging Area
	Orange Beach – Staging Area
	Dauphin – Staging Area
	Bayou LaBatre – **Claims Office** 290 N. Wintzell Avenue Bayou LaBatre, AL 36509
	Foley – **Claims Office** (Orange Beach/Gulf Shores/Bon Secour) 1506 North McKenzie Street (HWY 59), Suite 104 Foley, AL 36535
	Gulf Shores / Orange Beach – **Claims Office** 24039 Perdido Beach Blvd Suite 1 Orange Beach, AL 36561

ξ Community Outreach Centers now open in 2 counties.

ξ Volunteer update includes 59 miles of beach cleaned up.

ξ Staffing claims centers with adjusters to process claims, looking at opening additional claims offices.

Karen St John

BP America

Sr. Director, Regulatory Affairs

(202) 457-6594

(202) 351-1399 (cell)

stjohnk@bp.com

Received(Date): Mon, 24 May 2010 10:28:20 -0400
From: Beth Dieveney <Beth.Dieveney@noaa.gov>
Subject: May 24 NOAA Deepwater Horizon Call Actions
To: Deepwater <Deepwater.HorizonDist@noaa.gov>

For Official Use Only/Not for Public Release
NOAA Daily DeepWater Horizon Call
Monday, May 24, 2010; 0800
[redacted]

Call Guidelines:

- Place your phone on mute at all times unless you are speaking
- **Do not** place your phone on hold

Action Items

- Engage oil spill community and hurricane community to familiarize on data, processes, communication strategies so that if hurricanes occur in the gulf, we can have a coordinated message and approach; include EPA in conversations and follow-up actions (NWS, ORR)
- Consider deploying ORR staff to sit in the NHC to support FEMA on the ground (ORR)
- Do a briefing for meteorologists on the ground in the coastal states that are prepared with information and talking points regarding oil spill and hurricanes (ORR, NWS)
- Identify what our hurricane response plan is in light of a hurricane, both Unified Command and NOAA assets (Westerholm/ICC)
- Follow-up for 3pm Oil Spill 101 WH Press Briefing (Kenney/ORR)
- Dispersant workshop – provide information on plans, who is invited, etc. for outreach to public and federal agencies, etc. (Gray/Kenney)
- Follow-up on EPA water quality monitoring plan (Rolfe at NIC/Westerholm), potentially item to be raised at a Principal call.
- Follow-up meeting among science players to ensure tight coordination across NOAA (Kennedy, team)
- Succinct email for where we are on making data public and where that data will be housed (Klimavicz)
- Rolling out seafood safety results this week, ensure is well coordinated (NMFS)

Beth Dieveney
NOAA Program Coordination Office
Office of the Under Secretary
14th & Constitution Ave., NW, Room 5811
Washington, DC 20230

phone: 202 482 1281
cell: 240 328 4812
fax: 202 482 4116

Received(Date): Mon, 24 May 2010 19:00:45 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update: May 24, 2010

Attached you will find three items:

1. BP Press Release: Update on Gulf of Mexico Oil Spill Response

2. BP Press Release: BP Pledges $500 million for Independent Research into Impact of Oil Spill on Marine Environment

3. Communications regarding dispersant use in the Gulf of Mexico

Please let me know if you have questions. Karen

1.

Press Release

May 24, 2010

UPDATE ON GULF OF MEXICO OIL SPILL RESPONSE

BP today provided an update on developments in the response to the MC252 oil well incident in the Gulf of Mexico.

-

Subsea Source Control and Containment

Subsea efforts continue to focus on progressing options to stop the flow of oil from the well through interventions via the blow out preventer (BOP) and to collect the flow of oil from the leak points. These

efforts are being carried out in conjunction with governmental authorities and other industry experts.

Plans continue to develop a so called “top kill” operation where heavy drilling fluids are injected into the well to stem the flow of oil and gas and ultimately kill the well. Successfully killing the well may be followed by cement to seal the well. Most of the equipment is on site and preparations continue for this operation, with a view to deployment in a few days.

This is a complex operation requiring sophisticated diagnostic work and precise execution. As a result, it involves significant uncertainties and it is not possible to assure its success or to put a definite timescale on its deployment.

Drilling of the first relief well, which began on May 2 continues as does drilling of a second relief well, begun on May 16. Each of these wells is estimated to take some three months to complete from the commencement of drilling.

Work goes on to optimize the oil and gas collected from the damaged riser through the riser insertion tube tool (RITT). The collection rate continues to vary, primarily due to the flow parameters and physical characteristics within the riser.

In the period from May 17^{th} to May 23rd, the daily oil rate collected by the RITT has ranged from 1,360 barrels of oil per day (b/d) to 3,000 b/d, and the daily gas rate has ranged from 4 million cubic feet per day (MMCFD) to 17 MMCFD.

In the same period, the average daily rate of oil and gas collected by the RITT containment system at the end of the leaking riser has been 2,010 barrels of oil per day (BOPD) and 10 MMCFD of gas. The oil is being stored and gas is being flared on the drillship Discoverer Enterprise, on the surface 5,000 feet above.

The RITT remains a new technology and both its continued operation and its effectiveness in capturing the oil and gas remain uncertain.

The US Government has appointed a flow rate technical team (FRTT) to determine the well flow rate. The FRTT includes the US Coast Guard, NOAA, MMS, Department of Energy and the US Geological Survey. BP will continue to promptly provide all information necessary to make as accurate an assessment as possible of the rate of flow.

Surface Spill Response and Containment

-

Work continues to collect and disperse oil that has reached the surface of the sea. Over 1,100 vessels are involved in the response effort, including skimmers, tugs, barges and recovery vessels.

Intensive operations to skim oil from the surface of the water have now recovered, in total, some 243,000 barrels (10.2 million gallons) of oily liquid. The total length of boom deployed as part of efforts to prevent oil reaching the coast is now nearly 2.5 million feet, including over 730,000 feet of sorbent boom.

In total, over 22,000 personnel from BP, other companies and government agencies are currently involved in the response to this incident. So far 23,000 claims have been filed and 9,000 have already been paid.

The cost of the response to date amounts to about $760 million, including the cost of the spill response, containment, relief well drilling, grants to the Gulf states, claims paid and federal costs. It is too early to quantify other potential costs and liabilities associated with the incident.

2.

Press Release

May 24, 2010

-

BP PLEDGES $500 MILLION FOR INDEPENDENT RESEARCH INTO IMPACT OF SPILL ON MARINE ENVIRONMENT

-

BP today announced a commitment of up to $500 million to an open research program studying the impact of the Deepwater Horizon incident, and its associated response, on the marine and shoreline environment of the Gulf of Mexico.

“BP has made a commitment to doing everything we can to lessen the impact of this tragic incident on the people and environment of the Gulf Coast. We must make every effort to understand that impact. This will

be a key part of the process of restoration, and for improving the industry response capability for the future. There is an urgent need to ensure that the scientific community has access to the samples and the raw data it needs to begin this work," said Tony Hayward, BP's chief executive.

The key questions to be addressed by this 10-year research program reflect discussions with the US government and academic scientists in Washington DC last week. BP will fund research to examine topics including:

· Where are the oil, the dispersed oil, and the dispersant going under the action of ocean currents?

· How do oil, the dispersed oil and the dispersant behave on the seabed, in the water column, on the surface, and on the shoreline?

· What are the impacts of the oil, the dispersed oil, and the dispersant on the biota of the seabed, the water column, the surface, and the shoreline?

· How do accidental releases of oil compare to natural seepage from the seabed?

· What is the impact of dispersant on the oil? Does it help or hinder biodegradation?

· How will the oil, the dispersed oil, and the dispersant interact with tropical storms, and will this interaction impact the seabed, the water column and the shoreline?

· What can be done to improve technology:

- To detect oil, dispersed oil, and dispersant on the seabed, in the water column, and on the surface?

- For remediating the impact of oil accidently released to the ocean?

BP already has ongoing marine research programs in the Gulf of Mexico. Building on these, BP will appoint an independent advisory panel to construct the long term research program. Where appropriate, the studies may be coordinated with the ongoing natural resources damages assessment. The program will engage some of the best marine biologists and oceanographers in the world. More immediately, a baseline of information for the long term research program is needed. A first grant to Louisiana State University will help kick start this work.

"LSU has a significant amount of experience in dealing with the oil and gas industry and deep knowledge pertaining to the Gulf of Mexico across numerous topical disciplines. The first part of the program is about obtaining and analyzing samples and assessing immediate impacts. Other areas of importance will emerge as researchers become engaged and the potential impacts from the spill are better understood," said Professor Christopher d'Elia, Dean of the School of the Coast and Environment.

Subsequent awards will be controlled by the independent advisory board.

-

<u>Notes to editors</u>:

- BP has been collaborating with the Scripps Institution of Oceanography since 2004 in a program aimed at gaining a better understanding of the environment and hazards in oceans, including marine electromagnetic research. The focus of oceanography efforts has been loop currents in the Gulf of Mexico.

- In 2008, as part of the Deepwater Environmental Long-term Observatory System (DELOS), BP installed the world's first system designed to monitor deep-sea marine life. DELOS is supported by Texas A&M in Galveston, Scripps Institution of Oceanography, Monterey Bay Aquarium Research Institute, University of Aberdeen, National Oceanography Centre in Southampton and the University of Glasgow.

3.

Dispersant Use in the Gulf of Mexico

BP, in conjunction with the Unified Command, has been utilizing two types of dispersant for both air-based and subsea applications, *Corexit 9500* and *Corexit 9527*. Nearly 705,000 gallons of dispersant have been applied on the surface, and 116,000 gallons have been applied directly to the subsea location of the primary leak. Dispersants are a chemical used to break up oil into small droplets that can be broken down and degraded more easily through natural processes.

Last week, the Environmental Protection Agency (EPA) directed BP to identify one or more <u>pre-approved</u> dispersant products that are available in sufficient quantities, are as effective at dispersing oil as the *Corexit* products, and have generally lower toxicity levels. BP completed that review and sent a letter to EPA on Thursday, which can be found here: http://www.epa.gov/bpspill/dispersants/5-21bp-response.pdf

In brief, the alternative approved dispersants were either not available in sufficient quantities, or contained certain detergents that may degrade into compounds known as endocrine disruptors that have been linked to potential human health risks by some authorities. BP continues to work closely with EPA and the Coast Guard to monitor the effect of dispersants on the environment.

On Saturday, the Deepwater Horizon Unified Command issued a press release on the subject, which can found at the following link: http://www.deepwaterhorizonresponse.com/go/doc/2931/559595/

Karen St John

BP America

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Received(Date): Mon, 24 May 2010 14:24:13 -0400
From: Beth Dieveney <Beth.Dieveney@noaa.gov>
Subject: BP Oil Dispersants
To: _NOAA HQ leadership <NOAAHQ.Leadership@noaa.gov>,David Kennedy <David.Kennedy@noaa.gov>,Dave Westerholm <Dave.Westerholm@noaa.gov>,Craig McLean <Craig.Mclean@noaa.gov>, Judy Gray <Judy.Gray@noaa.gov>,Eric Schwaab <Eric.Schwaab@noaa.gov>, 'John Oliver' <John.Oliver@noaa.gov>,Brian T Pawlak <Brian.T.Pawlak@noaa.gov>,Steve Murawski <Steve.Murawski@noaa.gov>,_HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>
4distribution-1.doc

All~

Attached is a partial list of ingredients for both corexit products. The list is a combined list for both Corexit 9500 and Corexit 9527. At this point, a detailed formula will not be available from EPA until May 29th, and that list would be subject to CBI rules. We are working on getting the detailed list to you faster and without the CBI limitation.

Please forward to those in NOAA that needs this data.

Regards,
Beth

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>

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Beth Dieveney
NOAA Program Coordination Office
Office of the Under Secretary
14th & Constitution Ave., NW, Room 5811
Washington, DC 20230

phone: 202-482-1281
cell: 240-328-4812
fax: 202-482-4116

The following list of chemicals has been developed for distribution by EPA.

Item	CAS Registry Number	Chemical Name (TSCA Inventory)
1	57-55-6	1,2-Propanediol
2	111-76-2	Ethanol, 2-butoxy-
3	577-11-7	Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1)
4	1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate
5	9005-65-6	Sorbitan, mono-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs.
6	9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs
7	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-
8	64742-47-8	Distillates (petroleum), hydrotreated light

Received(Date): Tue, 25 May 2010 12:34:23 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update May 24, 2010

Attached you will find two items:

1. Press release regarding BP's ongoing review of potential causes of the Deepwater Horizon incident

2. Today's update

Please let me know if you have questions.

Press Release

BP Briefs Government on Initial Perspectives of Deepwater Horizon Investigation

Focus is on Seven Control Mechanisms

Release Date: 24 May 2010

BP announced today that its internal investigation team began sharing initial perspectives of its review of the causes of the tragic Deepwater Horizon fire and oil spill. The investigation is a fact-finding effort that has not reached final conclusions, but has identified various issues for further inquiry. BP has shared these early perspectives with the Department of the Interior and will do so with all official regulatory inquiries into the accident as requested.

This is an internal investigation. There is extensive further work to do – including further interviews, and in addition full forensic examinations of the Blow Out Preventer (BOP), the wellhead, and the rig itself - all of which are still currently on the sea bed. The internal investigation was launched on April 21, 2010 and is being conducted by BP's Head of Group Safety and Operations. He has an independent reporting line to the Group Chief Executive.

The investigation team's work thus far shows that this accident was brought about by the failure of a number of processes, systems and equipment. There were multiple control mechanisms— procedures and equipment—in place that should have prevented this accident or reduced the impact of the spill: the investigation is focused on the following seven mechanisms.

1. The cement that seals the reservoir from the well;
2. The casing system, which seals the well bore;
3. The pressure tests to confirm the well is sealed;
4. The execution of procedures to detect and control hydrocarbons in the well, including the use of the BOP;
5. The BOP Emergency Disconnect System, which can be activated by pushing a button at multiple locations on the rig;
6. The automatic closure of the BOP after its connection is lost with the rig; and
7. Features in the BOP to allow Remotely Operated Vehicles (ROV) to close the BOP and thereby seal the well at the seabed after a blow out.

"I understand people want a simple answer about why this happened and who is to blame. The honest truth is that this is a complex accident, caused by an unprecedented combination of failures," said Chief Executive Tony Hayward. "A number of companies are involved, including BP, and it is simply too early – and not up to us – to say who is at fault."

"This is a basic summary of the facts as gathered by the investigation team to date. A lot remains unknown, but we hope that the briefings will help the government's inquiries. This was a tragic accident and we need to understand the causes of it to try to ensure that nothing like it ever happens again."

For further information:

BP Gulf of Mexico response: www.bp.com/gulfofmexico

Telephone:

BP Press Office London +44 20 7496 4076

BP Press office, US: +1 281 366 0265

Gulf of Mexico Oil Spill Response Update

05/24/2010 – 8:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;
2. On the Surface to minimize impacts of the spill; and
3. Onshore to protect the shoreline and inform the public.

Highlights

- 17,840 personnel responding as part of the Unified Command, plus volunteers.
- 1,167 cleanup vessels deployed, including 80 skimmers.
- 592,000 gallons of additional oily water recovered and treated on Sunday.
- Decision from EPA allows subsea dispersant application to continue.
- $28 million in total claims paid to date.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

1. Riser Insertion Tube – The riser insertion tool is now capturing an average of approximately 2,000 barrels of oil per day. This remains a new technology and both its continued operation and its effectiveness in capturing the oil and gas remain uncertain.

2. Dispersant injection on the sea floor – Today, the Environmental Protection Agency (EPA) determined that subsea application of the currently-used dispersant could continue. EPA also announced it would conduct additional toxicity tests of available dispersant types and continue working to identify alternatives. Remote Operated Vehicles (ROVs) injected approximately 14,400 gallons of dispersant today at main riser leak source. Dispersant acts by separating the oil into small droplets that can break down more easily through natural processes before it reaches the surface. Successful application of dispersant on the sea floor can dramatically reduce the need for dispersant use on the surface.

3. "Top Kill" activities

- The "top kill" system which consists of system includes bypass lines, valves, and a manifold is currently being pressure tested.
- Final preparations and safety reviews will continue through tomorrow.
- After diagnostics are completed, engineers expect to begin pumping heavy fluids and/or fibrous materials directly through the blowout preventer in an attempt to kill the well.

4. Drilling relief wells

- The first relief well (work being performed by the Development Driller III) is at approximately 11,100 feet below sea level. This well was "spudded" on May 2.
- The second relief well (work being performed by Development Driller II) is at approximately 8,600 feet below sea level. Drilling began on May 16.
- Both wells are situated approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. It is estimated the total drilling process for each well will take at least 90 days

5. Containment Recovery System – A containment dome, called a "top hat," is deployed on the sea floor and readied to be placed over the main leak, if needed.

Offshore – Surface Spill Response

- **Cleanup Vessels** – 1,167 specialty response vessels are now deployed, including tugs, barges and recovery boats.

ξ **Skimming Vessels** – 80 of the cleanup boats are skimmers, designed to separate oil from water. Approximately 258,000 barrels of oil-water mix (10.84 million gallons) have been recovered and treated, an increase of more than 1 million gallons since Friday.

ξ **Surface Dispersant** – More than 705,000 gallons of dispersant have been applied on the surface by aircraft. BP is working with the EPA to identify alternative effective dispersants for deployment.

ξ **In-Situ Burning** – The Unified Command conducted an additional 8 in-situ burns on Sunday. In-situ burning occurs on the surface using special fire-boom that collects surface hydrocarbons which are then burned off.

Onshore - Shoreline Protection and Community Outreach

Oil Containment and Shoreline Protection – 2,750,000 feet of both sorbent and barrier boom have been deployed or staged to protect sensitive coastal areas in Louisiana, Mississippi, Alabama, and Florida. Nearly 1.5 million feet of barrier boom is on order.

Claims for Damages - BP has opened 18 claims offices to help claimants through the process. Vietnamese and Spanish translators are in some offices. 23,500 claims have been filed and 9,000 claims paid totalling $28 million. Most of the claims are for loss of income or wages in commercial fishing, shrimping, oyster harvesting, and associated activities. The contact number for claims is (800) 440-0858. In person claims can be filed at office locations listed below. Claims can also be filed online at: http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138

-

ξ **$500 million for a ten-year research program to study impacts of the Deepwater Horizon incident,** and its associated response, on the marine and shoreline environment of the Gulf of Mexico.

BP Provides $70 million in Tourism Grants to States – BP has made $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism.

$25 Million Block Grants to 4 States – On May 4, BP announced it would provide Louisiana, Florida, Mississippi and Alabama $25 million each to accelerate implementation of the States' approved Area Contingency Plans.

ξ **"Vessels of Opportunity" Program**– Nearly 5,000 contracts have been approved and 1,100 vessels are currently active. Community Outreach Centers are working with the contractors to ensure

they have the appropriate training.

- **Volunteers and Training** – BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Volunteers are being trained in five different modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. As of today, 14,628 individual training modules had been completed. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

- **Wildlife Activities** – 21 additional reports of impacted wildlife were received in the past 24 hours, bringing the total number to 132. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

Summary of Regional Operations and Outreach	
Louisiana Sites:	Robert – Unified Area Command
	Houma – Incident Command Post
	Pointe A La Hache – Community Outreach Center
	Venice – Community Outreach Center, Staging Area
	Grand Isle – Staging Area
	Port Fourchon – Staging Area
	Cocodrie – Staging Area
	Shell Beach – Staging Area
	Slidell – Staging Area
	St. Mary – Staging Area
	Amelia – Staging Area
	Belle Chasse – **Claims Office** 2766 Belle Chasse Hwy Belle Chasse, LA 70037
	Cut Off – **Claims Office** Tarpon Heights Shopping Center Unit 2 16263 E. Main Street Cut Off, LA 70345
	Grand Isle – **Claims Office** 3811 LA 1

	Grand Isle, LA 70358
	Hammond – **Claims Office** Worley Operations Center 303 Timber Creek Hammond, LA 70404
	Houma – **Claims Office** Plaza Caillou Shopping Center 814 Grand Caillou Road Suite 2 & 3 Houma, LA 70363
	Pointe A La Hache – **Claims Office** 1553 Hwy 15 Pointe A La Hache, LA
	St. Bernard – **Claims Office** 1345 Bayou Rd Saint Bernard, LA 70085
	Venice – **Claims Office** 41093 Hwy LA 23 Boothville, LA 70038

- Community Outreach Centers now open in 8 parishes.

- BP donated $1 million and is working with Catholic Charities and Second Harvest Food Bank in St. Bernard, Plaquemines and Orleans Parishes to deliver humanitarian assistance.

Mississippi Sites:	Pascagoula – Community Outreach Center, Staging Area
	Biloxi – Community Outreach Center, Staging Area
	Waveland – Community Outreach Center
	Pass Christian – Staging Area
	Bay St. Louis – **Claims Office** 1171 Highway 90

	Bay St. Louis, MS 39520
	Biloxi – **Claims Office** 920 Cedar Lake Rd, Suite K Biloxi, MS 39532
	Pascagoula – **Claims Office** 5912 Old Mobile Hwy Suite 4 Pascagoula, MS 39563

- Community outreach centers are now open in all three coastal counties.
- Volunteer update includes 37 miles of beach cleaned up.

Alabama Sites:	Mobile – Incident Command Post, Community Outreach Center
	Theodore – Staging Area
	Orange Beach – Staging Area
	Dauphin – Staging Area
	Bayou LaBatre – **Claims Office** 290 N. Wintzell Avenue Bayou LaBatre, AL 36509
	Foley – **Claims Office** (Orange Beach/Gulf Shores/Bon Secour) 1506 North McKenzie Street (HWY 59), Suite 104 Foley, AL 36535
	Gulf Shores / Orange Beach – **Claims Office** 24039 Perdido Beach Blvd

	Suite 1 Orange Beach, AL 36561

- Community Outreach Centers now open in 2 counties.
- Volunteer update includes 59 miles of beach cleaned up.

Florida Sites:	St. Petersburg – Incident Command Post
	Pensacola – Community Outreach Center, Staging Area
	Panama City – Staging Area
	St. Joe – Staging Area
	St. Marks – Staging Area
	Apalachicola – **Claims Office** 194 14th Street Suite 105 Apalachicola, FL 32320
	Ft. Walton – **Claims Office** 348 SW Miracle Strip Pkwy Suite 13 Fort Walton Beach, FL 32548
	Gulf Breeze – **Claims Office** 5668 Gulf Breeze Pkwy Unit B-9 Gulf Breeze, FL 32563
	Panama City – **Claims Office** 7938 Front Beach Road Panama City Beach, FL 32408
	Pensacola – **Claims Office** 3960 Navy Boulevard

	Suite 16-17 Pensacola, FL 32507
	Port St. Joe – **Claims Office** 106 Trade Circle Suite A Port St. Joe, FL 32456

- Community Outreach Centers are now open in 7 counties.
- Volunteer update includes 130 miles of beach cleaned up.
- Working with counties to review Area Contingency Plans and identify booming and beach clean up priorities.

Contact Information	
Environment / Community Hotline – to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife – to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers – to request volunteer information	(866) 448-5816
Services – to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity – to report and register boats available to assist with response	(281) 366-5511
Training – for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit – email suggestions to horizonresponse@piersystemcom	
Investor Relations	(281) 366-3123
Claims – by phone	(800) 440-0858
Claims – http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138	
Joint Information Center – Robert, LA – Media and information center	(985) 902-5231 or (985) 902-5240
Joint Information Center – Mobile, AL – Media and information center	(251) 445-8965
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765
BP Family – and third-party contractor hotline	(281) 366-5578
Twitter: Oil_Spill_2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

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stjohnk@bp.com

Received(Date): Tue, 25 May 2010 16:07:06 -0400
From: "Jainey.Bavishi" <Jainey.Bavishi@noaa.gov>
Subject: Briefing Paper
To: "Sarri, Kristen" <KSarri@doc.gov>,"'dwh.staff@noaa.gov'" <dwh.staff@noaa.gov>
May 25 Deepwater Horizon Update.doc

Kris,

The briefing paper is attached. Let me know if there are additional
topics or information you would like to see included.

Thanks,
Jainey

UPDATE ON DEEPWATER HORIZON RESPONSE

DATE:
Tuesday, May 25, 2010

PURPOSE:
To provide brief updates on "hot topics" related to Deepwater Horizon response and NOAA's continuing role.

BACKGROUND:
Flow Rate:
- The National Incident Command's Flow Rate Technical Group (FRTG) is expected to deliver a flow rate no later than May 26.
- The FRTG is already pointing to a release rate that is greater than 5,000 barrels/day, and BP concedes that the 5,000 barrels/day estimate is too low.
- NOAA scientists are participating in the FRTG to develop a scientifically valid estimate of the leak rate.
- Video image quality has been an issue, and NOAA and USCG are working with BP to secure high quality footage of the riser flow. It is anticipated that the new footage will allow a better estimate of release rate.

Subsurface Plume:
- Subsurface surveillance sampling continues off Mississippi, Alabama and Florida, and no oil has been detected.
- Multiple research cruises are underway to better characterize the fate and distribution in the water column.
    - NOAA Ship Gordon Gunter will depart on Thursday, May 27 to characterize the water column in the vicinity of the main release to inform response and fishery closure decisions.
    - NOAA Ship Thomas Jefferson departed Sunday to monitor the surface and deep currents distributing the oil.
    - NOAA Research Vessel Weatherbird has been deployed to conduct water sampling and depth and deploy gliders to see if sub-surface materials have entered the loop current in dispersed but detectable quantities.

Dispersed Oil Workshop:
- NOAA is sponsoring a workshop on the long-term use of dispersants, which will be held on May 26 and 27 at Louisiana State University.
- Thirty-forty people, including federal, state and academic experts, will be attending.
- Dispersants are one of several response tools, approved by the Regional Response Team, used at this spill. To date, a large quantify of dispersants have been applied (approximately 700,000 gallons) for the Deepwater Horizon response. The use of dispersants pose an environmental tradeoff, as dispersing the oil in the water column reduces the environmental risks to the shorelines.
- The purpose of this meeting is to assess the overall use of dispersants, the environmental tradeoffs, and provide recommendations to the Region 4 and 6

Regional Response Teams on the advisability of continuing the current level of dispersant operations.

Science Summit:

- On June 3, the USG (NOAA, OSTP, EPA, NSF, DOI, Coast Guard) is co-sponsoring a science meeting being organized by the Consortium for Ocean Leadership at Louisiana State University.
- This meeting will bring together representatives from federal response agencies with a broader representation (100 – 150 participants) of the non-federal research community. The meeting will also provide an opportunity for representatives of the agencies involved in the Federal response to present the work and science that is being done, solicit input to enhance understanding of the magnitude and impacts of the spill, and support the federal response.
- Anticipated outcomes include novel approaches for characterizing the magnitude, fate, and transport of the oil and dispersants; and recommendations for short- and long-term research priorities for evaluating ecological and human impacts; and novel approaches to data accessibility, quality and integrity.
- Given the challenge, we expect the formation of semi-permanent working groups to focus on specific research questions arising from this meeting. Admiral Thad Allen (USCG) will present the keynote, Shere Abbott (OSTP), and Marcia McNutt (USGS) will report on previous summits. Dr. Lubchenco will also likely attend. DHS has the lead on the communications plan.

Seafood Safety:

- NOAA and FDA have been working with EPA and OMB to ensure that seafood harvested from the Gulf of Mexico is safe for consumers.
- To date, a re-opening protocol for areas closed to commercial and recreation fishing has been agreed to, and all federal partners continue to work on a surveillance sampling plan to test for contaminants in areas outside of the closure area. Three additional steps: dockside sampling, long-line trawl sampling, and market-based sampling are all in some stage of development.
- A roll-out of the re-opening protocol, as well as baseline and post-spill testing results, is tentatively planned for June 2, 2010.

Barrier Island Proposal:

- The State of Louisiana has submitted a modified permit request to the U.S. Army Corps of Engineers to construct sand "berms" as an oil spill response mechanism.
- The Corps of Engineers has requested comments on the proposal from the natural resource agencies, including NOAA, EPA, and DOI.
- The National Incident Commander will make the final decision on whether the proposed activity is an appropriate response mechanism.
- Currently, there are many concerns about the environmental impacts and efficacy of the proposal.

Received(Date): Tue, 25 May 2010 17:49:59 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: FW: Pre-brief at 9:05 on Wednesday
To: dwh.staff@noaa.gov, 'Monica Medina' <Monica.Medina@noaa.gov>,'David Kennedy' <David.Kennedy@noaa.gov>, Dave.Westerholm@noaa.gov,'Margaret Spring' <Margaret.Spring@noaa.gov>,'Sally Yozell' <Sally.Yozell@noaa.gov>, "'Gray, John'" <John.Gray@noaa.gov>,'Amanda Hallberg Greenwell' <Amanda.Hallberg@noaa.gov>
Cc: Jen.Pizza@noaa.gov,"'Jacqueline J. Rousseau'" <Jacqueline.J.Rousseau@noaa.gov>

Monica and David Kennedy are scheduled for Wednesday, Thursday and Friday.

From: McGrath, Shaun L. [mailto:Shaun L. McGrath@who.eop.gov]
Sent: Tuesday, May 25, 2010 4:55 PM
To: McGrath, Shaun L.; Belton, Linda; Monica Medina; heather.smith1@dhs.gov; Tennyson, Stephanie L; Pallone.Sarah@epamail.epa.gov; Lori Faeth; Kayyem, Juliette; Murk, David CDR
Subject: Pre brief at 9:05 on Wednesday

All,

Draft agenda for the pre-call tomorrow is below. Please let me know if there are any changes.

Wednesday, May 26 Call with Governors

9:05 a.m. pre-brief; 9:15 Governors

[redacted]

HOST Pin [redacted] – Speakers

[Guest Pin [redacted]]

DRAFT AGENDA

-

· Observations and Trajectory – **Monica Medina and David Kennedy, Medina, NOAA**

o NOAA will provide the latest observations and trajectories

o Jindal – Will the eastern currents continue to hold the oil from moving further West into the Cappolia's (sp!)?

o Jindal – Will the currents/conditions continue to keep the oil from moving North up the MS Sound?

o

· Situation &Leak Stabilization Update – **RADM Peter Neffenger, NIC**

o Latest information from National Incident Command, including current status of efforts to stabilize the leaks.

o Jindal – are we seeing decreased amounts of oil coming ashore given all of the skimming, burns, dispersants? Neffenger, not sure, but we are getting a lot of oil out of the water.

o Neffenger –

§ in Houma today – will meet with Gov. Jindal

§ will try to meet Gov. Barbour later this week

§ riser insertion now down to 1200-1500 barrels/day (any explanation to this?)

§ Top Kill starts tomorrow

§ Barrier/berm – expect a decision later today

§ Preliminary numbers on flow rate and volume from task force soon

Operations Report – **RADM Mary Landry, UAC**

o Response Plans and Boom

o Moving skimmers and vessels – concentrating on 15 mi offshore from Chandeleurs

o Enclosing wildlife refuges with boom; Biloxi Marsh

o Boom is over 100% of plans for many of the areas in LA

o Barbour – are you deploying boom to Wrigley's? Yes Jindal— why, that doesn't seem to track with NOAA report that oil not moving that far. Answer – we are leaning forward.

o Jindal – Want to reconcile Coast Guard's boom numbers. Hearing from Plaquemines Parish Pres. that numbers do not match what they are counting. They think CG is counting boom that is just passing through to somewhere else.

o Jindal – will the Coast Guard start directing the boom deployment? Answer = Yes, CG is tactically directing the boom and Gov should weigh in with his CG liaison.

· EPA Update – **EPA Dep Admin BobPerciasepe**

· Open discussion and Q&A with Governors and state officials

· Next call – 9:15 a.m. EDT (8:15 CDT) Thursday, May 26, 2010

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Received(Date): Wed, 26 May 2010 12:15:10 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update: May 25

Update Regarding ROV Monitoring of 'Top Kill' Procedure

BP today confirmed that following detailed discussion with the National Incident Commander, Admiral Thad Allen, it will continue to provide live video feeds from the seabed throughout the planned 'top kill' procedure - the attempt to stop the flow from the damaged MC252 well by pumping heavy drilling fluids into it.

Preparations for this procedure are continuing with the expectation that it could be activated on the morning of Wednesday May 26, 2010.

Throughout the extended top kill procedure - which may take up to two days to complete - very significant changes in the appearance of the flows at the seabed may be expected. These will not provide a reliable indicator of the overall progress, or success or failure, of the top kill operation as a whole. BP will report on the progress of the operation as appropriate and on its outcome when complete.

Gulf of Mexico Oil Spill Response Update

05/25/2010 – 7:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;

2. On the Surface to minimize impacts of the spill; and

3. Onshore to protect the shoreline and inform the public.

Highlights

ξ 16,578 personnel responding as part of the Unified Command.

ξ 4,362 trained volunteers engaged in assisting Unified Command.

ξ Lower Marine Riser Package cap fabricated and shipped to location.

ξ 1,225 cleanup vessels deployed, including 80 skimmers.

ξ 14 controlled burns conducted on Monday.

ξ 3 new claims offices opened.

- $29.4 million in total claims paid to date.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

1. Riser Insertion Tube – The riser insertion tool continues to capture oil and natural gas. This remains a new technology and both its continued operation and its effectiveness in capturing the oil and gas remain uncertain.

2. Dispersant injection on the sea floor – The Environmental Protection Agency (EPA) has determined that subsea application of the currently-used dispersant can continue. Surface use of dispersant can continue, but at reduced levels. In addition, EPA will conduct its own toxicity testing of the available dispersant types and will continue working with BP on alternatives. Remote Operated Vehicles (ROVs) are currently injecting approximately 14,000 gallons of dispersant per day at the main riser leak source on the sea floor.

3. "Top Kill" Activities

- The "top kill" system includes bypass lines, a manifold, and valves that are being pressure tested. An animated description of the procedure can be found on the Deepwater Horizon Unified Command website at: http://wwwdeepwaterhorizonresponse.com/go/site/2931/
- Final preparations and safety reviews continued today.
- Once diagnostics are completed, engineers expect to pump heavy fluids and/or fibrous materials directly through the blowout preventer in an attempt to kill the well.

4. Drilling relief wells

- The first relief well (work being performed by the *Development Driller III*) is at approximately 10,100 feet below sea level. This well was "spudded" on May 2. Currently cementing the casing.
- The second relief well (work being performed by *Development Driller II*) is at approximately 8,650 feet below sea level. Drilling began on May 16. Currently cementing casing.
- Both wells are situated approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. It is estimated the total drilling process for each well will take at least 90 days

5. Containment Recovery System

- A Lower Marine Riser Package (LMRP) cap has been fabricated and shipped to the location. This cap is designed to fit directly over the LMRP on top of the blowout preventer once the broken riser pipe is removed. If needed, the cap would be attached to a riser pipe to convey oil and gas from the well directly to the *Enterprise* drill ship on the surface.

- Additionally, a containment dome, called a "top hat," is deployed on the sea floor and readied to be placed over the main leak, if needed.

Offshore – Surface Spill Response

- **Cleanup Vessels** – 1,167 specialty response vessels are now deployed, including tugs, barges and recovery boats.

- **Skimming Vessels** – 80 of the cleanup boats are skimmers, designed to separate oil from water. Approximately 262,100 barrels of oil-water mix (more than 11 million gallons) have been recovered and treated.

- **Surface Dispersant** – More than 705,500 gallons of dispersant have been applied on the surface by aircraft. BP is working with the EPA to identify alternative effective dispersants for deployment.

- **In-Situ Burning** – The Unified Command conducted an additional 14 in-situ burns on Monday. In-situ burning occurs on the surface using special fire-boom that collects surface hydrocarbons which are then burned off. Note: 53 burns have been conducted to date; removing approximately 62,000 barrels of oil from the surface.

Onshore - Shoreline Protection and Community Outreach

- **Oil Containment and Shoreline Protection** – 1,912,064 feet of containment boom have been deployed or staged to protect sensitive areas identified in the states' Area Contingency Plans (ACPs). 1,160,075 feet of containment boom is on order. 534,400 feet of sorbent boom is deployed, with another 1,280,000 million feet staged and ready for deployment.

ξ **Claims for Damages** - BP has opened 25 claims offices to help claimants through the process. Vietnamese and Spanish translators are in some offices. 24,650 claims have been filed and approximately 9,500 claims have been paid totalling $29.4 million. Most of the claims are for loss of income or wages in commercial fishing, shrimping and oyster harvest, and associated facilities. Note: No person asserting a claim or receiving payment for interim benefits will be asked or required to sign a release or waive any rights to assert additional claims, to file an individual legal action, or to participate in other legal actions associated with the Deepwater Horizon incident. The contact number for claims is (800) 440-0858. In person claims can be filed at office locations listed below. Claims can also be filed online at: http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138

ξ **$500 Million for 10-year Research Program to Study Spill Impacts** – On Monday, BP announced it will contribute $500 million to fund an open research program studying the impact of the Deepwater Horizon incident, and its associated response, on the marine and shoreline environment of the Gulf of Mexico.

ξ **BP Provides $70 million in Tourism Grants to States** – BP has made $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism.

ξ **$25 Million Block Grants to 4 States** – On May 4, BP announced it would provide Louisiana, Florida, Mississippi and Alabama $25 million each to accelerate implementation of the States' Area Contingency Plans.

ξ **"Vessels of Opportunity" Program** – Nearly 5,200 contracts have been signed and 1,114 vessels are currently active. Community Outreach Centers are working with the contractors to ensure they have the appropriate training.

ξ **Volunteers and Training** – BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Volunteers are being trained in five different modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. As of today, 16,239 individual training modules had been completed, an increase of 1,600 since Sunday. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

ξ **Wildlife Activities** – 6 additional reports of impacted wildlife were received in the past 24 hours, bringing the total number to 138. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

Summary of Regional Operations and Outreach		
	Robert – Unified Area Command	

Louisiana Sites:	**Houma – Incident Command Post**		
		Pointe A La Hache – Community Outreach Center	
		Venice – Community Outreach Center, Staging Area	
		Grand Isle – Staging Area	
		Port Fourchon – Staging Area	
		Cocodrie – Staging Area	
		Shell Beach – Staging Area	
		Slidell – Staging Area	
		St. Mary – Staging Area	
		Amelia – Staging Area	
		Belle Chasse – Claims Office 2766 Belle Chasse Hwy Belle Chasse, LA 70037	
	Cut Off – **Claims Office** Tarpon Heights Shopping Center Unit 2 16263 E. Main Street Cut Off, LA 70345		
	Grand Isle – **Claims Office** 3811 LA 1 Grand Isle, LA 70358		
	Hammond – **Claims Office** Worley Operations Center 303 Timber Creek Hammond, LA 70404		
	Houma – **Claims Office** Plaza Caillou Shopping Center 814 Grand Caillou Road Suite 2 & 3 Houma, LA 70363		
	New Orleans – **Claims Office** 4375 Michoud Blvd		

	New Orleans, LA 70461
	Pointe A La Hache – **Claims Office** 1553 Hwy 15 Pointe A La Hache, LA
	Slidell – **Claims Office** 2040 Gause Blvd., Suite 10 Slidell, LA 70461
	St. Bernard – **Claims Office** 1345 Bayou Rd Saint Bernard, LA 70085
	Venice – **Claims Office** 41093 Hwy LA 23 Boothville, LA 70038

- New claims office in St. Tammany Parish at Slidell, and new claims office for Orleans Parish in New Orleans.

- $17.2 million has been paid in claims in Louisiana.

Mississippi Sites:	Pascagoula – Community Outreach Center, Staging Area
	Biloxi – Community Outreach Center, Staging Area
	Waveland – Community Outreach Center
	Pass Christian – Staging Area
	Bay St. Louis – **Claims Office** 1171 Highway 90 Bay St. Louis, MS 39520
	Biloxi – **Claims Office** 920 Cedar Lake Rd, Suite K Biloxi, MS 39532
	Pascagoula – **Claims Office** 5912 Old Mobile Hwy

	Suite 4 Pascagoula, MS 39563

ξ Containment boom has been deployed or staged in all Tier 1 locations in the Mississippi Area Contingency Plan.

Alabama Sites:	Mobile – Incident Command Post, Community Outreach Center
	Theodore – Staging Area
	Orange Beach – Staging Area
	Dauphin – Staging Area
	Bayou LaBatre – **Claims Office** 13290 N. Wintzell Avenue Bayou LaBatre, AL 36509
	Foley – **Claims Office** (Orange Beach/Gulf Shores/Bon Secour) 1506 North McKenzie Street (HWY 59), Suite 104 Foley, AL 36535
	Gulf Shores / Orange Beach – **Claims Office** 24039 Perdido Beach Blvd Suite 1 Orange Beach, AL 36561

ξ Containment boom has been deployed or staged in all Tier 1 locations in the Alabama Area Contingency Plan.

Florida Sites:

St. Petersburg – Incident Command Post

Pensacola – Community Outreach Center, Staging Area

Panama City – Staging Area

St. Joe – Staging Area

St. Marks – Staging Area

Apalachicola – **Claims Office**

194 14th Street

Suite 105

Apalachicola, FL 32320

Crawfordville – **Claims Office**

3010 Crawfordville Hwy

Suite A&B

Crawfordville, FL 32327

Ft. Walton – **Claims Office**

348 SW Miracle Strip Pkwy Suite 13 Fort Walton Beach, FL 32548

Gulf Breeze – **Claims Office**

5668 Gulf Breeze Pkwy

Unit B-9

Gulf Breeze, FL 32563

Panama City – **Claims Office**

7938 Front Beach Road

Panama City Beach, FL 32408

Pensacola – **Claims Office**

3960 Navy Boulevard

Suite 16-17

Pensacola, FL 32507

Port St. Joe – **Claims Office**

106 Trade Circle

	Suite A Port St. Joe, FL 32456
	Santa Rosa Beach – **Claims Office** 5008 US Hwy 98W Unit 6&7 Santa Rosa Beach, FL 32459

ξ Claims office opens in Wakulla County at Crawfordville.

Contact Information	
Environment / Community Hotline – to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife – to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers – to request volunteer information	(866) 448-5816
Services – to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity – to report and register boats available to assist with response	(281) 366-5511
Training – for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit – File online at http://www.horizonedocs.com/index.html	
Investor Relations	(281) 366-3123
Claims – by phone	(800) 440-0858
Claims – http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138	
Joint Information Center – Robert, LA – Media and information center	(985) 902-5231 or (985) 902-5240
Joint Information Center – Mobile, AL – Media and information center	(251) 445-8965
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765
BP Family – and third-party contractor hotline	(281) 366-5578
Twitter: Oil_Spill_2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

BP America

Sr. Director, Regulatory Affairs

(202) 457-6594

(202) 351-1399 (cell)

stjohnk@bp.com

Received(Date): Wed, 26 May 2010 07:52:48 -0400
From: Tim Gallagher <timothy.gallagher@noaa.gov>
Subject: Morning Notes - DWH-MC252
To: dwh.staff@noaa.gov, Joe Inslee <Joe.Inslee@noaa.gov>,Ken Barton <Ken.Barton@noaa.gov>
Daily Update - 26May10.docx

Please see attached for the latest.

Yesterday overflight @ source and in vicinity observed considerably less oil than noted previously. Whether attributed to 27 in situ burns conducted since Sunday, subsea dispersant injection operations, high efficiency rates of skimmers, or the high draw of the sipper tube - the end result appears to be less oil on the surface. That assessment corroborated by aerial dispersant aircraft and skimmers experiencing difficulty finding target oil yesterday.

However, oil continues to wash ashore in the delta areas. Overflights did observe less oil & more sheens offshore & in convergence zones – potentially giving SCAT in the area an opportunity to remediate some of the impacted shores. Decent wx will allow the shoreline cleanup efforts to continue.

Overflight toward the Loop Current observed significantly less oil in the elephant's trunk and only sheens SE of 28N 88W. NGA SeaStar imagery indicated an anomaly 90 miles to the west of Tampa. Although NESDIS observed the same feature they were able to determine that it wasn't oil. However to resolve the discrepancy, we scheduled a flight from St Petersburg, FL to investigate.

Final checks conducted to prepare for the Top Kill procedure to begin this morning. As previously reported the process should take approximately one - two days to complete. It involves injecting drilling mud @ a rate in excess of 50 bbls/min through the BOP into the well bore to "choke" the flow. Followed by cement to "kill" the well.

The Top Kill comes on the heels of yesterday's announcement that the D/S Enterprise temporarily drew 8000 bbls/day through the sipper tube. The implication – @ minimum oil discharges from the riser @ 8000 bbls/day & most likely much more. The Flow Rate Technical Group should complete its calculations by the end of today with the President scheduled to announce the results tomorrow. Not to diminish the FRTG's tremendous effort, but hopefully a successful Top Kill will make those calculations no longer necessary.

AC Robert established data management plan for the science cruises underway or scheduled to take place. Still ongoing discussions concerning standardizing sampling protocols, reporting requirements, calibration of sensors & sample analysis. The WxBird indicated anomalous fluoremetry in the near surface & at depth approximately 45 miles from the source – water samples indicate no visible oil. The WxBird is operating independently of the coordinated science effort – as a result data flow into the Unified Command is not through prescribed channels. *(It's fluorometer is calibrated for Chlorophyll A which could give a false positive for oil. Even if the water samples indicate the presence of oil it dispels the theory that there is a big subsurface blob of oil. Again - you have people looking for oil that never have before. But the most significant problem with the WxBird is that they are not communicating emphasizes the necessity to communicate)*

The Gulf of Mexico dispersant conference gets underway this morning. With more than 830,000 gallons of dispersant applied so far in the response, the group's main objectives are to discuss dispersant loading in the Gulf and determine strategies to go forward.

Amid growing concerns of submerged oil heading toward them, Florida is developing plans to establish an Area Command out of Miami with unified commands in St Petersburg, Key West & JAX.

Reports yesterday of a shrimper hauling in oil with his catch to the west of the Dry Tortugas were confirmed to be a single tarball which was not retained for analysis.

Received(Date): Wed, 26 May 2010 10:10:31 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: FW: Urgent
To: John.Rapp@noaa.gov

This is what is happening...

-----Original Message-----
From: Monica Medina [mailto:Monica.Medina@noaa.gov]
Sent: Wednesday, May 26, 2010 10:07 AM
To: Sarri, Kristen; Medina, Monica; Belton, Linda; Medina, Monica; Stevens, Adele; Kennedy, David
Cc: Spring, Margaret
Subject: RE: Urgent

They are mad because we are testing the fish for toxicity of dispersants. Not just testing to see if the fish have dispersants in them. But rather testing the impact of dispersants on fish.

Monica Medina
Principal Deputy Under Secretary
National Oceanic and Atmospheric Administration
Department of Commerce
(202) 482-3567
monica.medina@noaa.gov

-----Original Message-----
From: Sarri, Kristen [mailto:KSarri@doc.gov]
Sent: Wednesday, May 26, 2010 10:03 AM
To: Medina, Monica; Belton, Linda; Medina, Monica; Stevens, Adele; Kennedy, David
Cc: Spring, Margaret
Subject: RE: Urgent

What's up?

-----Original Message-----
From: Monica Medina [mailto:monica.medina@noaa.gov]
Sent: Wednesday, May 26, 2010 10:01 AM
To: Belton, Linda; Medina, Monica; Stevens, Adele; Sarri, Kristen; Kennedy, David
Cc: Spring, Margaret
Subject: RE: Urgent

Talking to EPA - Bob P and Diane T now

Monica Medina
Principal Deputy Under Secretary
National Oceanic and Atmospheric Administration
Department of Commerce
(202) 482-3567
monica.medina@noaa.gov

-----Original Message-----
From: Linda belton [mailto:Linda.Belton@noaa.gov]
Sent: Wednesday, May 26, 2010 9:59 AM

To: 'Monica Medina'; 'Adele Stevens'
Subject: FW: Urgent

Please call her

-----Original Message-----
From: Pallone.Sarah@epamail.epa.gov [mailto:Pallone.Sarah@epamail.epa.gov]
Sent: Wednesday, May 26, 2010 9:52 AM
To: Linda.Belton@noaa.gov
Subject: Urgent

Hi Linda,

We are trying to reach David Kennedy, and Monica. Can you have them call Diane Thompson 202-564-1580?

Received(Date): Wed, 26 May 2010 10:30:44 -0400
From: Monica Medina <Monica.Medina@noaa.gov>
Subject: EPA sensitivity
To: "Fitzpatrick, Michael A." <Michael_A._Fitzpatrick@omb.eop.gov>,"Beck, Nancy" <Nancy_Beck@omb.eop.gov>,Steven Wilson <Steven.Wilson@noaa.gov>, John Rapp <John.Rapp@noaa.gov>,"Spring, Margaret" <Margaret.Spring@noaa.gov>,"'Steve.Murawski@noaa.gov'" <Steve.Murawski@noaa.gov>,"Kennedy, David" <David.Kennedy@noaa.gov>,"usha.vanarasi@noaa.gov" <usha.vanarasi@noaa.gov>,John E Stein <John.E.Stein@noaa.gov>, Nancy Thompson <Nancy.Thompson@noaa.gov>

Hi all – Our fisheries labs are doing testing using the dispersant samples we have received to look at the impact (toxicity) of dispersant on fish. We are doing this related to our seafood safety work. We talked about this testing in response to a question from Gov Jindal today on the Govs call. EPA is now mad because they did not realize (at least at the top levels) that we were doing this work. I thought EPA had been part of all the discussions on the protocols for seafood safety and what we are doing to test for impacts of oil and dispersants on fish. I need some assistance figuring out who at EPA has been part of all the protocol process so that I can make sure those people are connecting with their leadership within EPA. I told EPA that while we NOAA were doing this testing, we were not making "toxicity" determinations on our own – that is not strictly our responsibility – typically FDA would do that. However, when asked who was making this determination now, I said I thought it was this interagency group being run by OMB/OIRA and that EPA was involved. That is my understanding, but if I am wrong about that I need to correct the record with EPA.

Michael and Nancy – can you assist in particular? I think Bob P and Diane T there may need some reassurance that they have not been left out of the process.

Thanks! Monica

Monica Medina

Principal Deputy Under Secretary

National Oceanic and Atmospheric Administration

Department of Commerce

(202) 482-3567

monica.medina@noaa.gov

Received(Date): Wed, 26 May 2010 11:01:45 -0400
From: Monica Medina <Monica.Medina@noaa.gov>
Subject: Fw: FW: EPA sensitivity
To: "'David.Kennedy@noaa.gov'" <David.Kennedy@noaa.gov>,"'John.Oliver@noaa.gov'" <John.Oliver@noaa.gov>,"'eric.schwaab@noaa.gov'" <Eric.Schwaab@noaa.gov>,"'KSarri@doc.gov'" <KSarri@doc.gov>,"'margaret.spring@noaa.gov'" <Margaret.Spring@noaa.gov>,"'Steve.Murawski@noaa.gov'" <Steve.Murawski@noaa.gov>,"'john.rapp@noaa.gov'" <John.Rapp@noaa.gov>
Cc: "'usha.varanasi@noaa.gov'" <Usha.Varanasi@noaa.gov>

Hi all - See below. OK it has been almost a week since the initial request. Why does the NW lab not have a sample of the dispersant yet? Dave and John - can you make sure this happens today? Also if they are not testing the actual samples in NW, is the Pascagoula lab doing that testing. It was reported on our morning call that our labs are testing impacts of dispersants on fish. We at HQ need some basic information -- which labs are doing what tests on what types of fish. Administrator Jackson could complain to Dr L about what we are doing here. I have do doubt that we should be doing these tests but I need to know exactly what we are doing in order to defend it.

John Rapp - do you have time to run this to ground - I need a definite answer on this.

Thanks, Monica

From: Usha Varanasi <Usha.Varanasi@noaa.gov>
To: Monica Medina <Monica.Medina@noaa.gov>
Sent: Wed May 26 10:51:21 2010
Subject: Re: FW: EPA sensitivity

I can only speak for our lab. Just so you know, we are still trying to get the current dispersant from NOAA's OR&R folks who I assume are authorized for such exercise.
Meanwhile we are testing for some of our exposure set up for zebrafish embryo for sub lethal effects (such as cardiac dysfunction) using old sample of COREXIT dispersant. We are not doing classic toxicity test for water or fish.

Monica Medina wrote:

Monica Medina

Principal Deputy Under Secretary

National Oceanic and Atmospheric Administration

Department of Commerce

(202) 482-3567

monica.medina@noaa.gov

From: Monica Medina
Sent: Wednesday, May 26, 2010 10:31 AM
To: 'Fitzpatrick, Michael A.'; 'Beck, Nancy'; Steven Wilson; 'John Rapp'; Spring, Margaret; 'Steve.Murawski@noaa.gov'; Kennedy, David; 'usha.vanarasi@noaa.gov'; John E Stein; Nancy Thompson
Subject: EPA sensitivity

Hi all – Our fisheries labs are doing testing using the dispersant samples we have received to look at the impact (toxicity) of dispersant on fish. We are doing this related to our seafood safety work. We talked about this testing in response to a question from Gov Jindal today on the Govs call. EPA is now mad because they did not realize (at least at the top levels) that we were doing this work. I thought EPA had been part of all the discussions on the protocols for seafood safety and what we are doing to test for impacts of oil and dispersants on fish. I need some assistance figuring out who at EPA has been part of all the protocol process so that I can make sure those people are connecting with their leadership within EPA. I told EPA that while we NOAA were doing this testing, we were not making "toxicity" determinations on our own – that is not strictly our responsibility – typically FDA would do that. However, when asked who was making this determination now, I said I thought it was this interagency group being run by OMB/OIRA and that EPA was involved. That is my understanding, but if I am wrong about that I need to correct the record with EPA.

Michael and Nancy – can you assist in particular? I think Bob P and Diane T there may need some reassurance that they have not been left out of the process.

Thanks! Monica

Monica Medina

Principal Deputy Under Secretary

National Oceanic and Atmospheric Administration

Department of Commerce

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Usha Varanasi, Ph.D.
Science and Research Director
Northwest Fisheries Science Center, and
Acting Science and Research Director
Southwest Fisheries Science Center
DOC/NOAA/NMFS
Seattle: Phone   (206) 860 6795,   http://www.nwfsc.noaa.gov
La Jolla: Phone   (858) 546 7067,   http://swfsc.noaa.gov

"We must be the change we wish to see in the world..."   Mahatma Gandhi

Received(Date): Wed, 26 May 2010 12:35:26 -0400
From: John Rapp <John.Rapp@noaa.gov>
Subject: Dispersant sample
To: Dave Westerholm <Dave.Westerholm@noaa.gov>
Cc: David Kennedy <David.Kennedy@noaa.gov>,_HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>

Dave,

Dave Kennedy suggested that I contact you about securing a sample of dispersant for NW Fisheries Science Center to use as a part of their seafood testing protocols. Can you either handle this directly for me while you're down there or direct me to someone who I can work with? I need 2 liters expressed to Seattle. Address is:

Walt Dickhoff
2725 Montlake Blvd East
Bldg - East, Room 401
Seattle, WA 98112-2097

Thanks,
John

Received(Date): Wed, 26 May 2010 14:07:51 -0400
From: Justin Kenney <Justin.kenney@noaa.gov>
Subject: Fw: Understanding OR&R
To: "'noaahq.leadership@noaa.gov'" <NOAAHQ.Leadership@noaa.gov>,"'dwh.staff@noaa.gov'" <dwh.staff@noaa.gov>
Oil Spill Media Spill Political Spill.doc

Justin Kenney
NOAA Director of Communications
and External Affairs
Office: 202-482-6090
Cell: 202-821-6310
Facebook: www.facebook.com/noaa.lubchenco
(Sent from my BlackBerry)

----- Original Message -----
From: Gene Louden <gene.louden@noaa.gov>
To: Justin Kenney <justin.kenney@noaa.gov>; Scott Smullen <Scott.Smullen@noaa.gov>; Chris Vaccaro <christopher.vaccaro@noaa.gov>; David Miller <David.P.Miller@noaa.gov>; David L. Hall <David.L.Hall@noaa.gov>; Keeley.Belva <Keeley.Belva@noaa.gov>; Jana Goldman <Jana.Goldman@noaa.gov>; Linda Joy <Linda.Joy@noaa.gov>; Fred Gorell <fred.gorell@noaa.gov>
Sent: Wed May 26 06:04:09 2010
Subject: Understanding OR&R

Great article on what OR&R does. Will be in the clips package of course.
Best description I've seen on the work of this under-recognized office.

FOOD SAFETY NEWS: Oil Spill, Media Spill, Political Spill

Gene
--

Gene Louden
Senior Media Analyst
NOAA Communications and External Affairs
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Cell: (301) 518-6795
Land line: (301) 384-7183
Fax: (301) 384-9641
Email: gene.louden@noaa.gov
Join us on Facebook: www.facebook.com/noaa.lubchenco
Join us on Twitter: www.twitter.com/usnoaagov
see NOAA highlights on YouTube: www.youtube.com/usnoaagov

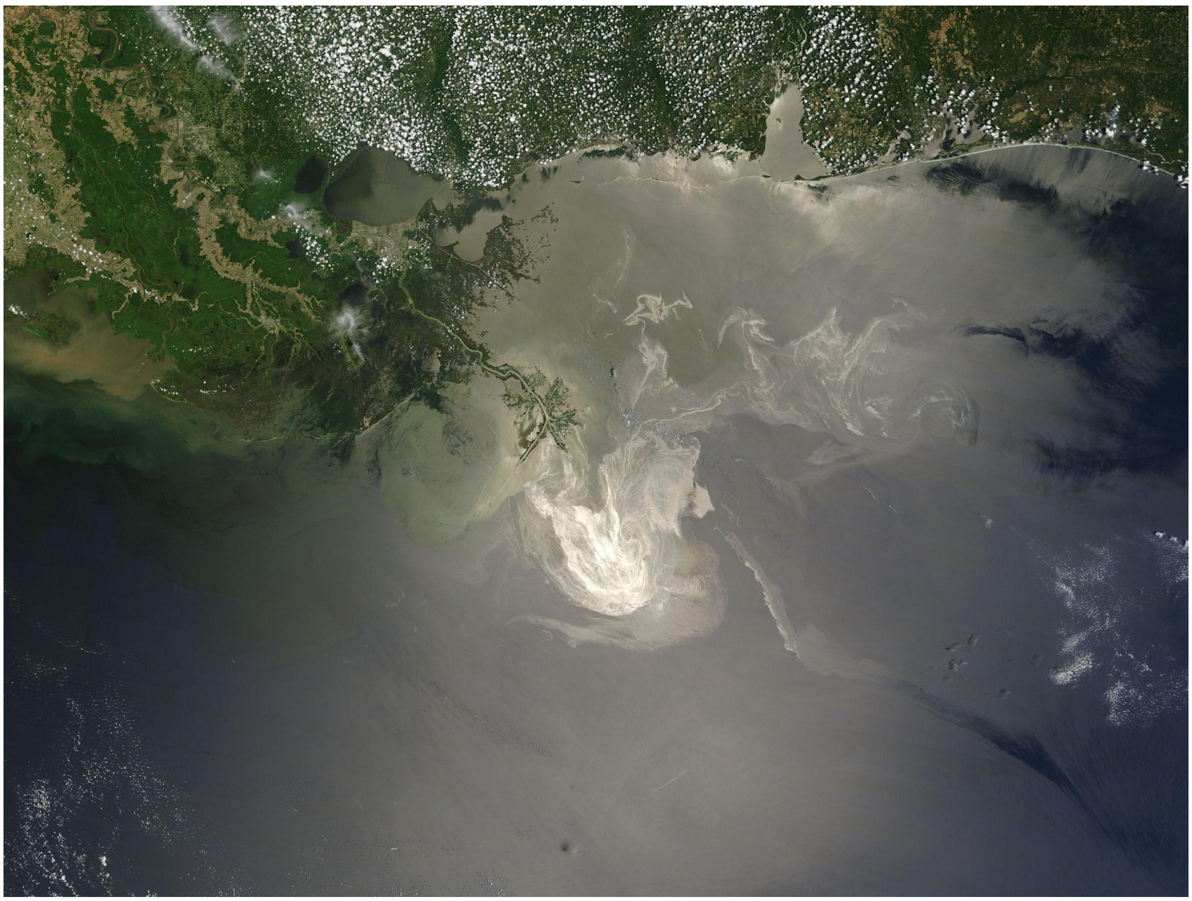
FOOD SAFETY NEWS

Science & Research

Oil Spill, Media Spill, Political Spill

by Ross Anderson | May 26, 2010

When BP's Deepwater Horizon oil rig exploded in the Gulf of Mexico last month, phones started ringing at the desks of federal scientists 2,200 miles away on the shores of Seattle's Lake Washington. Five weeks later, they're still ringing.



The scientists at NOAA's Office of Response and Restoration, or OR&R, are the nation's experts on oil spills. They attempt to quickly analyze what is at risk, and then advise the Coast Guard and other agencies what to do about it.

In a typical year, they deal with up to 200 spills, large and small, ranging from a beached barge on the Florida coast to a leaky pipeline on Alaska's North Slope.   Some have been at this job for more than 20 years, dating back to before the infamous Exxon Valdez spill of 1989.

Like most scientists, they prefer to work quietly, leaving the press conferences and politics to state and local officials closer to the scene. Their job is to quickly apply science and experience to the immediate crisis, unfettered by oil politics or environmental passions.

But the BP crisis soon became an oil spill in a league of its own, creating ugly and enormous challenges that didn't fit OR&R's playbook. The initial explosion and fire killed people. It happened a mile underwater. It was big, getting bigger by the hour, and they had no way to measure how big.

And suddenly, those mild-mannered scientists found themselves in the middle not just of an oil spill, but of a national media storm that was morphing into a political war zone.

In particular, they've been accused, by no less than the New York Times, of systematically understating the amount of oil that is gushing into the Gulf.

"It's the numbers game," says Doug Helton, who has had to deal with the press and politics while his colleagues deal with the oil. "I've learned a lot about the media age we're in."

It began April 20 as a "search and rescue" problem, Helton says. The rig was on fire, 11 oil workers were missing, and the platform included a storage tank filled with diesel fuel. The next day, the rig sank in 5,000 feet of water, and oil started gushing from broken pipes at the bottom.

Since then, the OR&R staff has worked virtually round-the-clock. They have command posts in Louisiana and Alabama, all linked into the windowless "War Room" in Seattle. Retired scientists have come back to help out.

But they've been stymied by the sheer scale, depth, and vast uncertainties swirling with that oily plume. Here's a glimpse at some of the challenges:

Numbers

While the initial estimate was 5,000 barrels per day, the NOAA experts knew it could be much larger. Early on, somebody scribbled the figure "64k-110k bbls/day" on a whiteboard, which was caught on a visitor's video. Critics took this as evidence that NOAA knew the leak was much worse than the official estimate, but was concealing the bad news.

That notation was a "worst case scenario," Helton says, scribbled during an early-morning briefing. Ultimately, the actual volume may prove to be that bad. "At some point, the actual volume doesn't matter," he says. "We don't know the number, and if we did there is nothing we would do any differently."

More important, he says, is the difference between a leaking tanker and a blown oil rig. "A tanker has a finite volume. You can reach out and touch it." But the leaking pipe just keeps gushing oil, under pressure, day by day until somebody figures out how to plug it.

History

OR&R's expertise stems strictly from experience. They analyze and recommend responses based on what they've seen with hundreds of previous spills. Much of that experience has been in the Gulf of Mexico, which sits atop massive oil deposits. Millions of gallons per year seep naturally into the gulf, and hardly a week passes without something spilling there. Tankers collide or run aground. Aging pipelines fail. Oil platforms spring leaks.

North America's largest had been the Mexican Ixtoc platform, which blew out in 1979 and spewed up to 300 million gallons into gulf waters over the span of nine months. Two months later, oil began to wash up on Texas beaches. It was an unholy mess, but the environment

seemed to recover within a year or two.

But the Ixtoc spill occurred in about 200 feet of water. BP's spill is something else again.

Depth

NOAA scientists have no experience with a spill 5,000 feet beneath the surface. The water at that depth is about 40 degrees Fahrenheit, which is colder than Alaskan waters. Oil being less dense than water, the stuff immediately goes to the surface, but they don't know what happens on the way up. And they don't know how to accurately measure how much oil is leaking.

"We've had some experience with oil from sunken vessels at the depth," Helton says. "But that oil is in smaller quantities and it isn't under pressure."

NOAA stores vast amounts of data on marine life along US shores, but scientists know relatively little about what lives a mile beneath the surface, let alone how deepsea organisms react to oil. A year or two from now, they'll know more, having learned the hard way.

Dispersants

Early on, OR&R recommended injecting chemical dispersants at the pipe. Scientists believe the chemicals are helping break huge plumes down into smaller drops that will evaporate or disperse more quickly.

But reporters and environmentalists wondered if pouring more chemicals into the sea wouldn't just exacerbate the problem. It's a tradeoff, Helton says. The chemistry of dispersants is similar to dish detergent, he says. "It spreads more oil at the surface."

But the questions keep coming.

Boom

State and local officials demand to know why the government hasn't installed oil booms along gulf shores to protect beaches. But NOAA's experience suggests that oil boom has limited uses, and you can't protect an entire seashore--especially when you don't know where or when the oil is going to come ashore.

"You don't want to shoot all your ammunition in the first few minutes of the battle," one scientist explains.

Once deployed, oil boom has a limited lifetime. Battered by waves and currents, plastic booms soon lose their effectiveness. So the trick is to have it available to protect specific shorelines as the slick approaches.

That strategy is not terribly comforting to gulf fishermen and others frustrated that nothing seems to be happening to protect their fishing grounds and beaches.

Which way did it go?

Whatever the size of the spill, it has taken its sweet time finding its way to Gulf beaches. In part, this may be because chemical dispersants are working as hoped--breaking the slick up into smaller particles that mix quickly with seawater or evaporate at the surface. Scientists also

believe that the spring outflow from the Mississippi River has washed much of the oil away from Louisiana shores.

The good news is that NOAA and other officials gained valuable time to prepare. The bad news is that hundreds of TV camera crews and reporters who converged on the scene, expecting to get film of oiled beaches, soon ran out of news to report. Questions about chemical dispersants and the exact volume of the spill became a national story.

Another wave of reports suggested a huge underwater plume of oil, 10 miles long, moving toward Florida. If this is the case, the NOAA scientists explain, "you'd have to suspend the laws of physics." Oil is lighter than water, so goes immediately to the surface. But the story persists.

And so it goes. Helton and his colleagues are hunkered down for the long haul. The "media spill" will wane and the politics will shift somewhere else. But the oil will keep gushing out of that hole in the bottom of the ocean.

Image Credit: NASA Earth Observatory. Sunlight illuminated the lingering oil slick off the Mississippi Delta on May 24, 2010. The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite captured this image the same day.

Oil smoothes the ocean surface, making the Sun's reflection brighter in some places, and reducing the scattering of sunlight in other places. As a result, the oil slick is brighter than the surrounding water in some places (image center) and darker than the surrounding water in others (image lower right). The tip of the Mississippi Delta is surrounded by muddy water that appears light tan. Bright white ribbons of oil streak across this sediment-laden water.

Tendrils of oil extend to the north and east of the main body of the slick. A small, dark plume along the edge of the slick, not far from the original location of the Deepwater Horizon rig, indicates a possible controlled burn of oil on the ocean surface.

To the west of the bird's-foot part of the delta, dark patches in the water may also be oil, but detecting a manmade oil slick in coastal areas can be even more complicated than detecting it in the open ocean.

Tags: BP, Deepwater Horizon, gulf oil spill, NOAA, oil spill

Received(Date): Wed, 26 May 2010 17:51:55 -0400
From: Kent Laborde <Kent.Laborde@noaa.gov>
Subject: DOC-NOAA DWH update-5-26-10 1700 notes
To: _HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>
DOC-NOAA DWH update-5-26-10 1700 notes.docx

Please see attached document for today's notes.

Kent

--
Kent Laborde
NOAA Program Coordination Office
U.S. Department of Commerce
1401 Constitution Ave., NW, Room 5811
Washington, DC 20230
phone: 202-482-3313
fax: 202-482-4116
cell: 202-425-2220
email: kent.laborde@noaa.gov

Received(Date): Wed, 26 May 2010 18:20:21 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: FW: Pre-brief at 9:05 on Thursday
To: dwh.staff@noaa.gov, 'Monica Medina' <Monica.Medina@noaa.gov>,'David Kennedy' <David.Kennedy@noaa.gov>, Dave.Westerholm@noaa.gov,"'Gray, John'" <John.Gray@noaa.gov>,'Amanda Hallberg Greenwell' <Amanda.Hallberg@noaa.gov>,'Margaret Spring' <Margaret.Spring@noaa.gov>
Cc: Jen.Pizza@noaa.gov,"'Jacqueline J. Rousseau'" <Jacqueline.J.Rousseau@noaa.gov>

Here is the agenda for tomorrow –

I have let Shaun know that David Kennedy will be the only NOAA principal on for tomorrow

From: McGrath, Shaun L. [mailto:Shaun L. McGrath@who.eop.gov]
Sent: Wednesday, May 26, 2010 6:07 PM
To: McGrath, Shaun L.; Belton, Linda; Monica Medina; heather.smith1@dhs.gov; Tennyson, Stephanie L; Pallone.Sarah@epamail.epa.gov; Lori Faeth; Kayyem, Juliette; Murk, David CDR; Moilanen, Stephen S.
Subject: Pre brief at 9:05 on Thursday

All,

Draft agenda for the pre-call tomorrow is below. Please let me know if there are any changes.

Thursday, May 27 Call with Governors

9:05 a.m. pre-brief; 9:15 Governors

[redacted] b6

HOST Pin: [redacted] b6 **– Speakers**

[Guest Pin: [redacted] b6

Please let me know if there are any changes to the speakers below. Also, please be prepared to cover the action items that came up on yesterday's call.

DRAFT AGENDA

· Opening remarks (Valerie Jarrett)

· Observations and Trajectory – **Monica Medina and David Kennedy, Medina, NOAA**

o NOAA will provide the latest observations and trajectories

o NOAA— there is less oil around the rig. Checking to see if it is due to subsea dispersants, burns, skimming.

o Jindal – how long does it take for the oil to move from leak site (rig) to land?

· Situation &Leak Stabilization Update – **RADM Peter Neffenger, NIC**

o Latest information from National Incident Command, including current status of efforts to stabilize the leaks.

o Top kill – will happen today. It will look real bad live. Will know after 3-4 hours if successful.

o Working on other options: containment cap; valve; BOP

o Jindal – if top kill fails, are the alternatives partial or complete solution. (Cap is partial; the other 2 are complete)

o Jindal – regarding the barrier proposal, he was supposed hear from Adm Allen yesterday but did not. Neffenger – Allen will call him today. Will it be update or decision? Hope for decision by COB.

Operations Report – **RADM Mary Landry, UAC**

o Response Plans and Boom

o Barbour – With the skimmers east of Chandeleurs and North, did you find oil? Landry, yes, skimming today. We will provide you more details at the end of the day. Landry: 2 issues: 1) skimmers 29 mi off of Chandeleur; 2) Test project entrance to Born and Ponchatraine. NEED to send this out to Jindal and Barbour

o Landry/Neffenger – there will be more oil released today (due to top kill)

o Jindal – St. Bernard – how do we alert you to availability of vessels? Contact CG? Yes, in each bay and each parish, there is a USCG rep. NEED to get the names and contact info out!

o Landry flying today to meet with Michael Baudet (sp?)

o Jindal – Asked that we give locals a sense of how much boom is coming. They need to be

able to prepare.

o Jindal – with NOAA's projections, we need to be prepared for oil's new movement to Chandeleur and north

· EPA Update – **EPA Dep Admin Bob Perciasepe**

o Admin Jackson – We need Govs help in discussing dispersants. Need to keep it science-based and factual, particularly in relation to seafood. Will send out TPs to the Govs.

o Jindal – asked for constituents of the dispersant.

o NOAA – also working on sampling of the seafood. Coordinating with EPA??

· Open discussion and Q&A with Governors and state officials

· Next call – 9:15 a.m. EDT (8:15 CDT) Thursday, May 26, 2010

-

Received(Date): Thu, 27 May 2010 06:54:19 -0400
From: John Rapp <John.Rapp@noaa.gov>
Subject: Fwd: Stranding Q&As
To: Richard.M.Love@noaa.gov
Cc: dwh.staff@noaa.gov
Historical comparisons turtle and mammal combined 5-19-10 FINAL
StrandingQuestions-response FINAL 5-19-10 1754.rtf
Brian_T_Pawlak.vcf
Attachment

Richard,

Also for today's briefing books, please print and add the historical
comparisons document from this email.

Thanks,
John

Begin forwarded message:

> From: Brian Pawlak <Brian.T.Pawlak@noaa.gov>
> Date: May 20, 2010 1:36:00 PM EDT
> To: Jenni Wallace <Jenni.Wallace@noaa.gov>, Christopher Meaney <Christopher.Meaney@noaa.gov
> >, John Rapp <John.Rapp@noaa.gov>
> Cc: "Lauren.B.Lugo" <Lauren.B.Lugo@noaa.gov>, John Oliver <John.Oliver@noaa.gov
> >, Beth Lumsden <Beth.Lumsden@noaa.gov>
> Subject: Re: Stranding Q&As
>

> Full suite of responses attached, this includes the Historical
> comparisons information as well...
>
> Jenni Wallace wrote:
>> Chris,
>> Attached are NMFS cleared Stranding Q&As.
>>
>> Jenni
>>
>
> --
> Brian Pawlak
> Deputy Director
> NOAA Fisheries Service
> Office of Habitat Conservation
> 301-713-2325 (167)
> 301-713-1043 (Fax)
>
>
>
>
>

Richard,

Also for today's briefing books, please print and add the historical comparisons document from this email.

Thanks,
John

Begin forwarded message:

> **From:** Brian Pawlak <Brian.T.Pawlak@noaa.gov>
> **Date:** May 20, 2010 1:36:00 PM EDT
> **To:** Jenni Wallace <Jenni.Wallace@noaa.gov>, Christopher Meaney <Christopher.Meaney@noaa.gov>, John Rapp <John.Rapp@noaa.gov>
> **Cc:** "Lauren.B.Lugo" <Lauren.B.Lugo@noaa.gov>, John Oliver <John.Oliver@noaa.gov>, Beth Lumsden <Beth.Lumsden@noaa.gov>
> **Subject: Re: Stranding Q&As**
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> Jenni Wallace wrote:
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> Deputy Director
> NOAA Fisheries Service
> Office of Habitat Conservation
> 301-713-2325 (167)
> 301-713-1043 (Fax)

Summary of Recent Marine Mammal Stranding Data in the Northern Gulf of Mexico

- The number of marine mammal strandings during the period of May 1-15 was slightly elevated during 2010 compared to the five-year historical average of strandings in the state of Louisiana, and consistent with the five-year historical averages for Mississippi, Alabama, and Florida (Figure 1). NOTE: no oiled mammals have been confirmed.
- Table 1 below provides the 5-year average marine mammal strandings and associated summary statistics, by month (April through August) and state for the northern Gulf of Mexico (LA, MS, AL, FL panhandle). The most recent available and validated 5 year time period, 2003-2007, was used. The primary species reported is the bottlenose dolphin (*Tursiops truncatus*).
- Three caveats apply to the numbers reported below: 1. In the Florida Panhandle, Unusual Mortality Events were declared in 2004 and 2006, during which an elevated number of strandings was reported. These events were determined to be caused by biotoxins. The data from these years are included in calculating the 5 year averages. 2. In Louisiana, systematic beach surveys were conducted in April 2003, resulting in a report of 14 stranded dolphins. 3. Dolphin strandings for 2010 were unusually high (at or well above the average stranding rates) in March and April, prior to the spill, for the Gulf region. The reason(s) are under investigation.
- Marine mammal stranding reports in the northern Gulf of Mexico rely upon opportunistic reporting, generally from members of the public. Remote coastlines and barrier islands are rarely surveyed. Due to the oil spill response, survey effort and human presence/awareness (aerial and ground) are higher than previous years and we believe that some unquantifiable portion of the increased stranding reports are likely a direct result of the increase in survey effort and human presence/awareness.

Figure 1. Comparison between the historical averages (error bars represent standard deviation) for reports from 2003-2007 and the number of confirmed marine mammal stranding reports in 2010 in the four Gulf Coast states. Both data sets represent the time period of May 1-14.

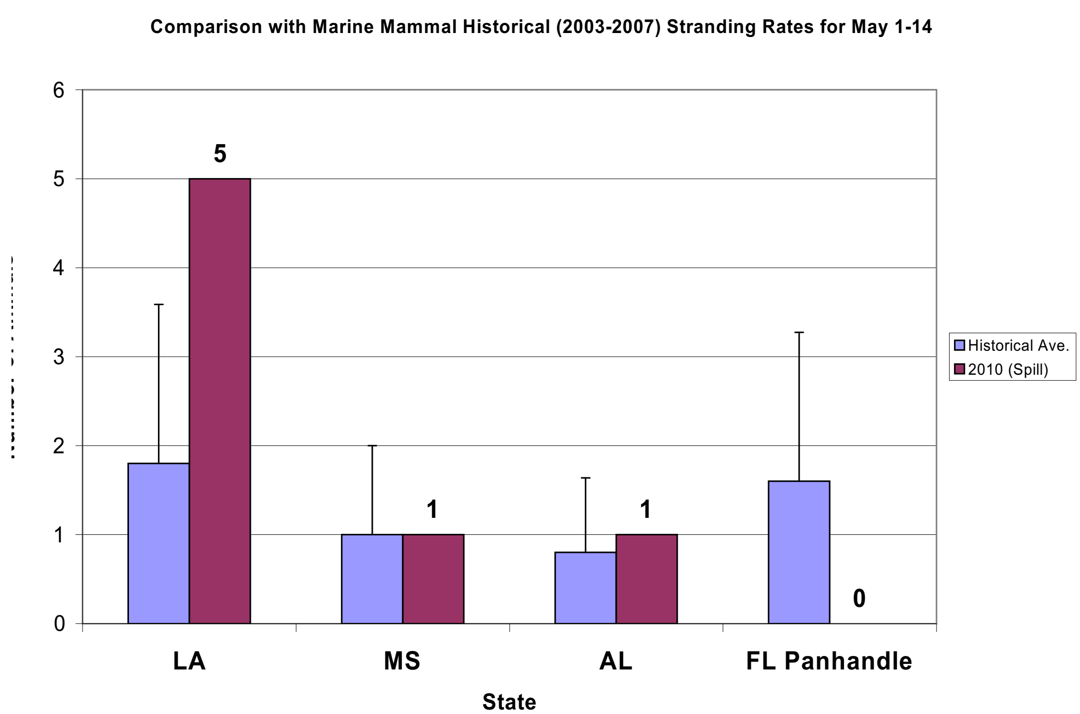

Table 1. Five-year stranding averages and summary statistics for LA through the FL panhandle. All cetacean species are combined. Data for all states is 2003-2007.

Louisiana			
[redacted]			
April	[redacted]ay	[redacted]ne	[redacted]y
[redacted]			
5-Yr Avg 5.6 Range 1-14** SD 5.6	[redacted]r Avg 2.2 [redacted]nge 0-4 [redacted] 1.8	[redacted]r Avg 1.2 [redacted]nge 0-5 [redacted] 2.2	[redacted]r Avg 1 [redacted]nge 0-2 [redacted] 1
Mississippi			
[redacted]			
April	[redacted]ay	[redacted]ne	[redacted]y
[redacted]			
5-Yr Avg 3 Range 0-12 SD 5.1	[redacted]r Avg 1.6 [redacted]nge 0-3 [redacted] 1.5	[redacted]r Avg .4 [redacted]nge 0-1 [redacted] 0.6	[redacted]r Avg 0.4 [redacted]nge 0-1 [redacted] 0.5
Alabama			
[redacted]			
April	May	June	July
[redacted]			
5-Yr Avg 2.8 Range 0-9 SD 3.8	[redacted]r Avg 1.2 [redacted]nge 0-3 [redacted] 1.1	[redacted]r Avg 0.6 [redacted]nge 0-1 [redacted] 0.5	[redacted]r Avg 1.2 [redacted]nge 0-3 [redacted] 1.3
Florida Panhandle (Escambia County - Franklin County)			
[redacted]			
April	May	June	July
[redacted]			
5-Yr Avg 3.8 Range 0-10* SD 4.4	[redacted]r Avg 1.4 [redacted]nge 0-4 [redacted] 1.7	[redacted]r Avg 0.8 [redacted]nge 0-2 [redacted] 0.8	[redacted]r Avg 0.4 [redacted]nge 0-1 [redacted] 0.5

* In 2004 and 2006, bottlenose dolphin Unusual Mortality Events occurred in the Florida Panhandle
** in 2003, LDWF conducted beach surveys and recorded 14 stranded dolphins

Summary of Recent Sea Turtle Stranding Data in the Northern Gulf of Mexico

- Figure 1 and Table 1 illlustrate and provide the 5-year average sea turtle strandings and associated summary statistics, by month (April through August) and state for the northern Gulf of Mexico (LA, MS, AL, FL panhandle). The most recent available and validated 5 year time periods for each state were used.

- The total number of sea turtle strandings documented from the Louisiana/Texas border through the Florida panhandle from April 30 through mid May is 156 (LA 36, MS 83, AL 26, FL - 11). This is significantly higher than the number of turtle strandings that have been documented in recent years in Louisiana, Mississippi, and Alabama during this time frame. For example, from 2005 2009 the number of turtle strandings for the full month of May has ranged from 1 to 15 in Louisiana, 0 to 13 in Mississippi, and 1 to 15 in Alabama. In the Florida panhandle, from 2003 2007, the number of strandings in May has ranged from 13 to 37.

- Sea turtle stranding coverage in the northern Gulf of Mexico, outside of Florida, has been incomplete in recent years. In LA, MS, and AL the majority of reported strandings are primarily opportunistic due to more remote coastlines and limited dedicated stranding surveys. In Louisiana systematic surveys, funded by NOAA, were conducted over approximately 30 miles of western Louisiana beaches in 2005, 2006, 2007 and through August 2008. The majority of strandings reported during those survey years are from the western beaches where dedicated surveys were conducted.

- Due to the oil spill response, survey effort and human presence/awareness (aerial and ground) is higher than previous years and we believe that some portion (unquantifiable) of the increased stranding reports now are likely a direct result of the increase in survey effort and human presence/awareness, however we do not believe it explains the full increase.

Figure 1. Comparison between historical averages for strandings from May 1-31 for 2003-2007 (FL panhandle) or 2005-2009 (LA,MS,AL), and the number of confirmed strandings May 1-15, 2010 from LA, MS, AL and FL panhandle. Error bars represent standard deviation.

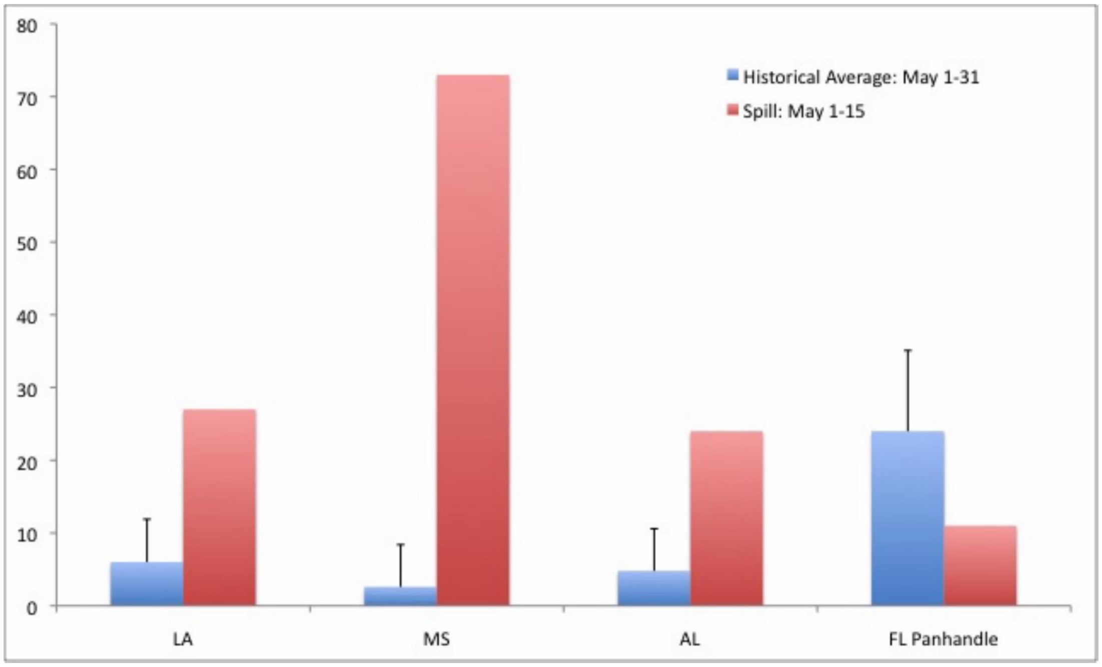
80
70
60
50
40
30
20
10
0
Historical Average: May 1-31
Spill: May 1-15
LA
MS
AL
FL Panhandle

Table 1. Five-year stranding averages and summary statistics for LA through the FL panhandle. All turtle species are combined. LA, MS, AL data for 2005 - 2009; Florida data for 2003-2007.

Louisiana (2005 - 2009)				
[redacted]				
April	ay	ne	y	gust
[redacted]				
5-Yr Avg 6 Range 0-1 SD 5.2	r Avg 6. nge 1-15 5.9	r Avg 1.2 nge 0-3 1.3	r Avg 1 nge 0-3 1.3	r Avg 1.0 nge 0-3 1.2
Mississippi (2005 - 2009)				
[redacted]				
April	May	June	July	August
[redacted]				
5-Yr Avg 2 Range 0-1 SD 4.3	r Avg 2. nge 0-13 5.8	r Avg 0.4 nge 0-1 0.5	r Avg 1 nge 0-8 3.6	r Avg 0.2 nge 0-1 0.4
Alabama (2005 - 2009)				
[redacted]				
April	ay	ne	y	gust
[redacted]				
5-Yr Avg 4 Range 0-8 SD 3.5	r Avg 4. nge 1-15 5.8	r Avg 1.4 nge 0-4 1.7	r Avg 2 nge 1-4 1.1	r Avg 1.8 nge 1-4 1.3
Florida Panhandle (Escambia County - Wakulla County) (2003 - 2007)				
[redacted]				
April	May	June	July	August
[redacted]				
5-Yr Avg 1 Range 13- 22 SD 3.6	r Avg 24 nge 13-3 11.1	r Avg 12 nge 5-17 4.4	r Avg 1 nge 7-2 8.6	r Avg 5 nge - 1-10 3.5

<date> Draft Internal Q&As Regarding Marine Mammal and Turtle Strandings

Question 1: NOAA asked that the report on marine mammals and turtles - be clearer regarding how many are deceased due to oil and what is not known; share a total each day (ORR/ICC reports).

This will now be reported daily through a summary of information on stranding and by providing tables that depict daily strandings and initial assessment of oiling status. Knowing if a stranded animal is stranded due to oil is not necessarily easy and quickly discernable. NOAA expects that many animals will be classified as "Pending" determination for some time until chemical analysis can be completed. Given the circumstances of this spill event and the exposure and effects that may be expected for marine mammals and sea turtles, the expression of external oiling may not be a viable sole assessment of impact or injury in these species. For birds this may make sense in that the principle cause of acute morbidity and mortality is from external oiling. That is likely not the case for marine mammals and sea turtles. Complete assessment of the role of this event (oil and dispersant) in morbidity and mortality of marine mammals and sea turtles will entail full necropsies with sample collection, analyses, and assessment. During this investigation phase, animals will be placed in the "pending" category, even when they have no gross evidence of oil. In some cases the cause of death may never be known, particularly if the carcass is decomposed when found. Therefore this information can be found in the text of the report as well as a new "Summary Totals" tab in the daily Excel spreadsheet.

Question 2: NOAA requested to create daily chart showing mortality in relation to: #of total dead turtles, # sent for necropsies, # necropsies completed, and # dead due to oil.

We have added a new table (Excel spreadsheet tab "Necropsy Status") to show this in the daily Excel spreadsheet. Please note that the completion of a necropsy does not necessarily complete the analyses needed to attempt to determine cause of death.

Question 3: We were asked to assess capacity to conduct necropsy work needed - request to review this and if more people are needed (marine mammal stranding, necropsy processing, etc). Where do these animals go for processing or rehabilitation? Who does the necropsy and rehabilitation. NOAA would benefit from a fuller explanation of how the stranding networks work. Main point here is are we anticipating what we need, and if we think we need more we should be asking for help.

At the current rate of strandings, the network has the needed capacity to verify and examine all stranded animals that are accessible. Through Unified Command we have secured additional contract help where identified to date. Given the expected length of this event, additional resources may be needed to supplement existing capacity. Should stranding rates increase and additional necropsy and pathology support be necessary, several other pathologists and biologists have been identified and are currently on standby to assist if requested. No large whales have stranded to date but the MMHSRP has a large whale necropsy manual and a few operational teams for response. All large whale necropsies would be conducted in the field. Due to the specialized experience required, there are only a few identified Large Whale Necropsy Team leaders; all are on standby and can travel to the Gulf coast if needed. The local stranding network responders would secure the carcass, and the necropsy could begin the next morning after the team was assembled.

<date> Draft Internal Q&As Regarding Marine Mammal and Turtle Strandings

Currently, four facilities are prepared to receive and care for live, distressed sea turtles: Audubon Aquarium of the Americas in New Orleans, LA, Institute of Marine Mammal Studies in Gulfport, MS, Gulfarium in Fort Walton Beach, FL, and Gulf World Marine Park in Panama City, FL. Three of these facilities (Audubon Aquarium, IMMS, and Gulf World) are also prepared to rehabilitate live stranded small cetaceans. These facilities were identified for the projected geographic area where marine mammals and sea turtles impacted by the oil spill may strand. Should the operations area change, the plan will be revised. All facilities have been augmented through the Unified Command for an expected moderate increase in stranding rates, and have been provided with the necessary equipment and supplies to collect samples according to the standardized protocols.

Stranding networks for both marine mammals and sea turtles have existed throughout the United States for decades prior to this event. In the Gulf of Mexico states (TX, LA, MS, AL, FL), there are numerous organizations authorized to respond to stranded or distressed marine animals (authorization is through agreements issued under the Marine Mammal Protection Act for marine mammals, under the Endangered Species Act for sea turtles, and under any applicable state laws). Each state has a designated coordinator for sea turtle strandings and TX, LA and FL have a state coordinator for the multiple organizations responding to marine mammal strandings; MS and AL are coordinated by the participating facilities. In the Atlantic and Gulf of Mexico, the sea turtle stranding network is operated under the guidance of a National Coordinator at the Southeast Fisheries Science Center, Miami, FL. The marine mammal stranding network has established NMFS regional coordinators. Reports of stranded animals may be called in by the general public, by resource managers, or during the spill response, by one of the many field operations teams. Normally, most strandings are reported through a passive system, in that a member of the public observes a stranding event and calls it in to the local network. During the Deepwater Horizon oil spill response, a more active surveillance system is in place. Strandings are reported by phone calls made either directly to the facilities, to another network contact (such as the State or Regional Coordinators), or to the wildlife hotline established for the oil spill response (1-866-557-1401). From any of these avenues, information is relayed to the appropriate response group, which conducts field operations to confirm the report and take appropriate action - either rescuing a live animal or collecting a carcass or appropriate samples from a dead animal. Responders consist of biologists or volunteers trained in stranding response. Each rehabilitation facility has an attending veterinarian who oversees the medical care and treatment of the animal while it is in rehabilitation.

All reports of distressed or stranded marine mammals or sea turtles are responded to as rapidly as possible. Although the aim is for these responses to be conducted the same day the report is received, delays may occur due to weather or logistics of accessing more remote areas.

For cetaceans, once the animal is verified, the network is conducting necropsies either in the field or in the laboratory whenever possible. Sea turtle necropsies have been conducted to date by Dr. Brian Stacy (NMFS and University of Florida School of Veterinary Medicine). For the majority of dolphins that have been reported during this response, necropsies and sampling have been conducted in the field because the animals have been decomposed, and the logistics of retrieving carcasses has been difficult. No stranded manatees have been reported to date, but they would be collected if possible and transported to pre-identified centers for rehabilitation or necropsy, under the authorization of USFWS.

For more information on the facilities involved in the Marine Mammal Stranding Network in the Gulf Coast region (LA-FL), see the attached Directory.

Question 4: Are the deaths and strandings investigated for causes other than oil? Specifically, does the necropsy provide for testing other than oil, including dispersant?

The full necropsy investigations of stranded marine mammals and sea turtles is not limited to detection of oil, oil exposure, or oil-associated injury but includes examination of human interactions, HAB-associated biotoxicosis, infectious agents and other causes. Environmental information, circumstances of stranding, and other potential mortality factors in an area are all considered during assessment. An inevitable limitation of necropsy is that many stranded animals are recovered in a decomposed state, which makes determination of a definitive cause of death difficult or impossible in many instances and impairs toxicological testing, such as PAH analysis. Microscopic examination (histopathology) is possible on very few stranded animals due to decomposition. The specific chemical composition of the dispersants have not been made available to those advising on the toxicological and medical aspects of the response, thus specific considerations relevant to detection of the dispersant or exposure are unknown. The protocol in place includes collection of samples suitable for a broad array of diagnostic testing and a suite of samples that may be useful for any forthcoming considerations related to dispersants.

Question 5: NOAA is still waiting for the historical data and trends on strandings in this area at this time of year for baseline understanding of what we are seeing now, what is the status of getting this report/data?

Please see the two attached documents which contain historical data and trends for sea turtle and marine mammal strandings in the northern Gulf of Mexico.

Brian Pawlak
Deputy Director
NOAA Fisheries Service
Office of Habitat Conservation

1315 East-West Hwy
Silver Spring, MD 20910

301-713-2325 ext 167 (Work)
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brian.t.pawlak@noaa.gov (Internet)

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Brian Pawlak

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Family: Pawlak
First: Brian
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Deputy Director

Telephone Number (Work)
301-713-2325 ext 167

Telephone Number (Fax)
301-713-1043

Version

2.1

Received(Date): Thu, 27 May 2010 15:12:36 -0400
From: "Lauren.B.Lugo" <Lauren.B.Lugo@noaa.gov>
Subject: [Fwd: Seafood Safety]
To: John Rapp <John.Rapp@noaa.gov>
Cc: Eric Schwaab <Eric.Schwaab@noaa.gov>, John Oliver <John.Oliver@noaa.gov>,Samuel Rauch <Samuel.Rauch@noaa.gov>,Nancy Thompson <Nancy.Thompson@noaa.gov>,Steve Murawski <Steve.Murawski@noaa.gov>,Beth Lumsden <Beth.Lumsden@noaa.gov>,Gloria Thompson <Gloria.Thompson@noaa.gov>,Rebecca Chiampi <Rebecca.Chiampi@noaa.gov>, Deb Lambert <Deb.Lambert@noaa.gov>
2010_0526_Opening Protocol_NMFS FDA clean copy.doc

John R.-- Despite our best efforts on the protocol, a sentence got through our review that we believe is not correct. The sentence is on page 3 under the "Re-opening Process" section that reads:
"Based on this assessment, NMFS may re-open federal waters subject to the closure and FDA may approve the fishery for interstate commerce."

NOAA Fisheries is not aware that FDA has authority to "approve a fishery for interstate commerce." We request that this sentence be revised to reflect FDA's correct authority.

Will you please pass this up the line?
Lauren

-------- Original Message --------

Subject: Seafood Safety
Date: Thu, 27 May 2010 15:04:54 -0400
From: Beck, Nancy <Nancy_Beck@omb.eop.gov>
To: Beck, Nancy <Nancy_Beck@omb.eop.gov>, Fitzpatrick, Michael A. <Michael_A._Fitzpatrick@omb.eop.gov>, Cuellar, Mariano-Florentino <Mariano-Florentino_Cuellar@who.eop.gov>, Mancini, Dominic J. <Dominic_J._Mancini@omb.eop.gov>, Malanoski, Margaret A. <Margaret_A._Malanoski@omb.eop.gov>, Rostker, David <David_Rostker@omb.eop.gov>, Perraut, Andrew B. <Andrew_B._Perraut@omb.eop.gov>, Stebbins, Michael J. <Michael_J._Stebbins@ostp.eop.gov>, Schmeissner, Peter J. <Peter_J._Schmeissner@ostp.eop.gov>, Murawski, Steve <Steve.Murawski@noaa.gov>, Mike.Taylor@fda.hhs.gov, Hansen, Timothy <Timothy.Hansen@noaa.gov>, Wilson, Steven <Steven.Wilson@noaa.gov>, Lugo, Lauren <Lauren.B.Lugo@noaa.gov>, Rapp, John <John.Rapp@noaa.gov>, Sarri, Kristen

<KSarri@doc.gov>, Medina, Monica <Monica.Medina@noaa.gov>, Donald.Kraemer@fda.hhs.gov, Dickey, Robert W <Robert.Dickey@fda.hhs.gov>, Boots, Michael J. <Michael_J._Boots@ceq.eop.gov>, Higginbottom, Heather A. <Heather_A._Higginbottom@who.eop.gov>, Onek, Matthew M. <Matthew_M._Onek@who.eop.gov>, Monje, Carlos A. <Carlos_A._Monje@who.eop.gov>, Weatherly, Mark A. <Mark_A._Weatherly@omb.eop.gov>, Lyon, Randolph M. <Randolph_M._Lyon@omb.eop.gov>, Reilly, Thomas M. <Thomas_M._Reilly@omb.eop.gov>, Fontenot, Keith J. <Keith_J._Fontenot@omb.eop.gov>, Garufi, Marc <Marc_Garufi@omb.eop.gov>, Levenbach, Stuart <Stuart_Levenbach@omb.eop.gov>, Frey, Nathan J. <Nathan_J._Frey@omb.eop.gov>, Molly.Muldoon@fda.hhs.gov, Dora.Hughes@hhs.gov, Michael.Landa@fda.hhs.gov, Buffa, Nicole <Nicole_Buffa@ceq.eop.gov>, Neyland, Kevin F. <Kevin_F._Neyland@omb.eop.gov>, Hagan, Michael B. <Michael_B._Hagan@omb.eop.gov>, Hart, Nicholas R. <Nicholas_R._Hart@omb.eop.gov>, Weiss, Michael I. <Michael_I._Weiss@ceq.eop.gov>, Monica Medina <monica.medina@vmail5.nems.noaa.gov>, Palm, Mary E. <Mary_E._Palm@ostp.eop.gov>, Usha Varanasi <Usha.Varanasi@noaa.gov>, Davenport, Joanne Chow <Joanne_Chow_Davenport@omb.eop.gov>, Bigler.Jeff@epamail.epa.gov, Linda Chaves <Linda.Chaves@noaa.gov>, Barringer, Jody M. <Jody_M._Barringer@omb.eop.gov>, Uhlenbrock, Kristan M. <Kristan_M._Uhlenbrock@ceq.eop.gov>, Engle.Virginia@epamail.epa.gov, Bolger, Philip M <Mike.Bolger@fda.hhs.gov>, Fong, Tera L. <Tera_L._Fong@omb.eop.gov>, Washington.Evelyn@epa.gov, Ohanian.Edward@epamail.epa.gov, Evelyn Washington/DC/USEPA/US

<Washington.Evelyn@epamail.epa.gov>, Radosevich, Tara J. <Tara_J._Radosevich@ceq.eop.gov>, Malhotra, Stefan <Sanjay_S._Malhotra@ceq.eop.gov>, Schoeny.Rita@epa.gov, Kimani Kimbrough <Kimani.Kimbrough@noaa.gov>, Koufopoulos, Peter N <Peter.Koufopoulos@fda.hhs.gov>, John E. Stein <John.E.Stein@noaa.gov>, Walton Dickhoff <Walton.W.Dickhoff@noaa.gov>, McCarthy, Nell <Nell_McCarthy@who.eop.gov>

Attached please find the revised protocol.

Lauren B. Lugo
NOAA Fisheries Service
Seafood Inspection Program
(301)713 2355 x145
fax: (301)713 1081

5/26/2010

PROTOCOL FOR INTERPRETATION AND USE OF SENSORY TESTING AND ANALYTICAL CHEMISTRY RESULTS FOR RE-OPENING OIL-IMPACTED AREAS CLOSED TO SEAFOOD HARVESTING

INTRODUCTION

The U.S. Food and Drug Administration (FDA) operates a mandatory safety program for all fish and fishery products under the provisions of the Federal Food, Drug and Cosmetic Act, the Public Health Service Act and related regulations. Actions and criteria discussed in this protocol should be followed in addition to the provisions already in place. The National Oceanic and Atmospheric Administration (NOAA) administers the status of Federal waters for seafood harvest. After an oil spill has occurred, Federal and State agencies are faced with the issue of determining when the seafood from the previously contaminated area may once again be safe for harvest and human consumption. NOAA Office of Response and Restoration (OR&R) publication entitled *Managing Seafood Safety after an Oil Spill*[1] provides agencies guidance in such situations. This guidance and other input from both NOAA and the FDA have been used in consultation with the Environmental Protection Agency (EPA) to establish this protocol.

In establishing this protocol it is important to understand the following principles:

- NOAA and the FDA are working with other federal and state agencies to protect consumers from adulterated and unsafe seafood, while minimizing undue economic burden on any impacted seafood industries.

- Once oil or chemical contaminants are visually observed on the surface, it is recommended that the fishery be closed until free of sheen, and subsequent testing has been completed to confirm that seafood from affected areas are wholesome and safe for human consumption and use in animal feed.

- After the initial fishery closure, the best approach for determining the safety and acceptability of seafood from oil-contaminated areas is one that involves organoleptic analysis of products (i.e. sensory testing) followed by chemical analysis.

- In establishing the closure areas, NMFS has placed a buffer zone around known contaminated waters to make certain a wide enough closure is in place. Areas within this closure may be re-opened when as it is determined oil contamination did not occur and the area was closed only as a precautionary measure. This protocol does not apply to re-openings of this nature.

Oil contamination presents two kinds of risks: the presence of petroleum taint that renders seafood unfit for human consumption, and the presence of polycyclic aromatic hydrocarbons (PAHs) that are chemical hazards. Federal government and state agencies therefore close oil-contaminated harvest areas for health reasons.

Oil-contaminated seafood is adulterated if the contamination is perceivable by olfaction (taint), or in the absence of taint, chemical analysis determines that the level of PAHs in it exceeds FDA levels of concern. Consequently, after an oil spill, seafood suspected of oil contamination can only be brought into interstate commerce when it passes both sensory testing for petroleum taint, and chemical analysis for PAHs.

The purpose of this protocol is to specify how the results of sensory testing and chemical analyses will be used in re-opening seafood closure areas. The principles of the protocol are as follows:

Generally:

1. The closure of a fishery assumes a worst case scenario, and is intended to protect seafood consumers until the safety of the seafood can be established.
2. Area re-opening will be based on an acceptable reduction of the threat of seafood exposure to oil contamination, and analyses that assure the safety and wholesomeness of the seafood. Threat of exposure will be based on past observations and the status of the spill and conditions.
3. Once seafood samples from an area pass sensory testing, area samples must also pass chemical analysis for PAHs before that fishery may be reopened.

Specific Re-opening Criteria:

1. Threat of exposure – Threat of exposure is sufficiently reduced based on past observations of previous spills, any baseline information collected, and the status of the spill and conditions.
2. Evaluation of oil movement – Confirmation that the closure area is free of sheen on the surface by visual observation and/or aerial reconnaissance, or the presence of oil in the water column through visual observation or water testing.
3. Assessment of seafood contamination by sensory testing – Determine if the seafood is contaminated by tissue collection and sensory testing. The acceptable condition is that all specimens must pass sensory testing conducted by an NMFS-FDA sensory panel following the protocol reviewed by the FDA.
4. Assessment of seafood contamination by chemical analyses – Chemical analyses are performed on samples that pass sensory assessment to confirm that PAH concentrations are below the applicable FDA levels of concern for human health.
5. Opening boundaries will be based on results of analyses (sensory and chemical) that demonstrate the product is:
   a. Untainted.
   b. Safe for human consumption.
6. Establish buffer zones between open and closed areas using chemical and sensory testing indices.
7. Re-openings may be fisheries specific.

ANALYSIS

1. NMFS sensory testing protocol reviewed by FDA.[2,3]
2. When sensory tested samples are acceptable, verify sensory testing outcomes with chemical analyses performed using the NMFS PAH method.[4]

ONGOING STUDIES

Additional investigation protocols may continue to be designed to assess sediment contamination, ecological injury and other environmental parameters. These investigations are not directly related to or considered a part of this protocol. However, data from these

investigations will be reviewed prior to making any decisions to reopen an area or a fishery and may be the basis for requiring additional sampling/analysis as per this protocol. For example, sediment chemical data from fishery areas may be used to identify contaminant "hot spots."

Water analysis for PAHs may be used to gain an understanding of the effectiveness of the containment and cleanup of the spill. In addition water analysis may be used to determine the concentration and effect of the dispersants used. Such water analysis may be performed on representative samples of the affected water column. The necessary sampling criteria will be based on many factors including the area of the closure, depth of the water within the closure, and sites and species considered for re-opening of harvest areas or fishery. With regard to inshore fisheries such as molluscan shellfish, sediment samples may also be analyzed.

Surveillance of fisheries should be conducted in response to identified "hot spots" or other relevant changes in environmental conditions (e.g., increases in PAH levels in water or seafood) if warranted, based on the protocol defined.

RE-OPENING PROCESS

NOAA and the FDA will review the data generated as a result of the implementation of this protocol, evaluate the accuracy and quality of the data and assess compliance with the agreed criteria. Based on this assessment, NMFS may re-open federal waters subject to the closure and FDA may approve the fishery for interstate commerce. NMFS and FDA will coordinate with State agencies for the re-opening of State commercial waters to ensure orderly and appropriately enforced re-openings. No partial re-openings will be allowed which are unenforceable, i.e., gear that requires harvesters to segregate their catch and discard catch from fisheries that remain closed.

Sensory testing based on NOAA Technical Memorandum NOS OR&R 9: *Guidance on Sensory Testing and Monitoring of Seafood for Presence of Petroleum Taint Following an Oil Spill*[2] will be utilized. A panel of ten expert assessors from NMFS and the FDA will conduct sensory testing. Samples will be examined by organoleptic methods both in the raw and cooked states. If a particular fishery passes sensory testing within a defined sampling area, chemical analyses will be performed on that particular fishery and area[4]. If the chemical analyses pass the risk based assessment criteria for the species in question, that zone will be considered for re-opening. If an area fails sensory testing it will be retested within a designated time period.

SELECTION OF TARGET PAHs and LEVELS OF CONCERN

Most petrochemical products such as diesel oil and crude oil contain aromatic components: mono-, bi-, and polycyclic aromatic hydrocarbons. Well-established liquid chromatography (LC)/fluorescence detection (FD) and gas chromatography (GC)/mass spectrometry (MS) methods are used to separate and quantify these contaminants in seafood.

PAHs are abundant in our environment; in addition to sources from petrochemical products they are generated by nearly all pyrolytic processes including forest fires, char-grilled and smoked meat, and fuel combustion in automobiles. Crude petroleum is composed of a complex mixture of many hundreds of compounds. Most of the compounds are volatile, and evaporate to produce the pungent odor of petroleum. Others are less volatile and persist in the environment (e.g. Formation of tar balls or sink to the bottom). The polycyclic aromatic hydrocarbons (PAHs) in petroleum mixtures are of greatest concern for human health because of their persistence (i.e.

Lower evaporation rates), and their potential for toxic or carcinogenic effects. The subset of 8 PAHs and their alkylated homologues (16) selected for critical analysis in the Deepwater Horizon Spill (Table I) are among the most studied PAHs in petroleum mixtures. These compounds have been found through experience with many previous oil spills (e.g. North Cape Oil Spill, 1996, Rhode Island) to reflect the potential for toxic or carcinogenic effects of the mixture of compounds present in crude petroleum[5].

Most seafood risk assessments conducted after oil spills in the U.S. have followed an approach used by the FDA in 1990 after the *Exxon Valdez* oil spill in Prince William Sound, Alaska[6,7]. This approach uses a set of calculations to determine finfish or shellfish (harvested for human consumption) PAH tissue concentrations, expressed in benzo[a]pyrene (BaP) equivalents (μg/kg), above which an appropriate risk level for cancer is exceeded. Non-cancer levels of concern are also evaluated. The values for several variables in these calculations can be adjusted on a case-by-case basis, depending on seafood consumption rates of the exposed population, average body weight of the exposed population, estimates of exposure time for a particular spill, and the cancer risk level deemed appropriate. This approach to calculating seafood advisory levels has since been used after several other oil spills, including the *North Cape* spill in Rhode Island, the *Julie N* spill in Maine, the *Kure* spill in California, and the *New Carissa* spill in Oregon.

The level of appropriate risk is the maximum level of individual lifetime carcinogenic risk that is considered appropriate by risk managers. The relative risk level used by FDA for low dose cancer risk calculations is 1×10^{-6}. This implies that exposure to PAH in seafood below a specified tissue concentration, at a defined consumption rate, and over a defined exposure period would yield a lifetime cancer risk of no greater than 1 in 1,000,000. A risk level of 1×10^{-6} was used in the risk calculations by FDA for the Exxon Valdez oil spill, as well as those done by the State of Rhode Island for the *North Cape* oil spill, the State of California for the *Kure* oil spill, and the State of Oregon for the *New Carissa* oil spill. Some states have considered higher risk levels, such as 1×10^{-5} (a lifetime cancer risk of no greater than 1 in 100,000) to be appropriate. For instance, a risk level of 1×10^{-5} was used in the risk assessment conducted by the State of Maine for the Julie N oil spill and the State of Alaska for the *Kuroshima* oil spill[1].

Depending upon levels of petrogenic PAHs accumulated by aquatic species, consumption of petroleum contaminated fishery products may pose a health risk to seafood consumers. The risk is exacerbated among those who are considered "high level" consumers of fishery products. These concerns necessitate consideration of consumption rates for high-level eaters of fish, shrimp, crab and shellfish in order to avoid errors inherent in extrapolating average per capita consumption values to distinct subpopulations. FDA uses the 90th percentile of national consumption data from the National Health and Nutrition Examination Survey (NHANES) for fish, shrimp, crab and shellfish for calculating risk of PAH exposure in high-level consumers of commercial seafood products.

Table I shows the criteria for re-opening based upon non-cancer risks and a 1×10^{-6} cancer risk for different PAHs. For the non-cancer evaluation (naphthalene, flourene and anthracene/phenanthracene) the EPA Integrated Risk Information System (IRIS) reference dose (RfD) values were used[8]. For the cancer evaluation (fluoranthene, pyrene, benz(a)anthracene, chrysene and benzo(a)pyrene), the EPA IRIS cancer slope factor values were used[9]. As discussed above, 90th percentile consumption values were used for generating calculations for

consumption of shrimp and crabs, oysters and finfish. For generating cancer risk values, exposures are assumed to last for 5 years.

Recent results from PAH chemical analysis of finfish (grouper, red snapper and red drum) collected by NOAA from the unaffected Dauphin Island area in early May show that PAH target levels shown in Table I are below detection limits (LOD <0.4 ppb). An evaluation of PAH chemical analysis data collected by the NOAA mussel watch program showed that in 2007-2008 average concentrations were below FDA levels of concern in oysters. Nevertheless, final determinations of opening status of oil spill affected fisheries and areas will take into consideration available PAH background level data, and assumptions on duration of exposure.

Criteria for Determining Sensory Testing Acceptability

A minimum of 6 sub-samples per species from each area under consideration is required. A sub-sample will consist of an individual organism for finfish and multiple organisms for shrimp and shellfish, depending on the intact animal type (e.g. 3 to 6 blue crabs, 6 oysters, 0.4 – 0.5 lb shrimp). The samples will be evaluated by a panel of a minimum of 10 expert assessors in the raw and cooked state.

For a closed fisheries area to be considered for reopening, all of the following tests must be performed (these criteria are based on past oil spill information and ensure a high confidence level that the seafood is not tainted by oil):

- A minimum of seventy percent (70%) of the expert assessors must find NO detectable petroleum or dispersant odor from each raw sub-sample. If any sub-sample fails, the site fails.
- A minimum of seventy percent (70%) of the expert assessors must find NO detectable petroleum or dispersant odor from each cooked meat sub-sample. If any sub-sample fails, the site fails.
- A minimum of seventy percent (70%) of the expert assessors must find NO detectable petroleum or dispersant taste (or flavor) in the cooked state. If any sub-sample fails, the site fails.
- In establishing the closure areas, NMFS has placed a buffer zone around known contaminated waters to make certain a wide enough closure is in place. Areas within this closure may be re-opened when as it is determined oil contamination did not occur and the area was closed only as a precautionary measure. This protocol does not apply to re-openings of this nature.

Sampling Criteria for Chemical Analyses

For crabs: Chemical analysis of edible muscle from a minimum of ten (10) individuals, of legal size if available, will be collected from each sampling site. Tissue samples from individual crabs will be combined to make separate composite samples of the muscle tissue and hepatopancreas. All crabs will be collected from sites selected as commonly used fishing grounds.

For all other seafood: Chemical analysis of a sample of edible tissue from a composite (of at least 200 grams) from a minimum of 10 or more individuals collected at or near the locations specified.

Table I

Criteria for Reopening Areas Closed from Oil Spills Based on Concentrations of Chemical Contaminants in Seafood

Chemical[1]	Levels of Concern (ppm) at a 10^{-6} cancer risk level			Basis[2]
	90 g/day (Shrimp and Crabs)	120 g'day (Oysters)	160 g/day (Finfish)	
Napthalene	31	23	20	Non cancer EPA RfD; 70 kg bw
Flourene	31	23	20	Non cancer EPA RfD; 70 kg bw
Anthracene/phenanthracene	233	175	150	Non cancer EPA RfD; 70 kg bw
Fluoranthene	0.026	0.020	0.015	Cancer 0.02 B(a)P equivalency
Pyrene	0.041	0.031	0.025	Cancer 0.13B(a)P equivalency
Benz(a)anthracene	0.38	0.28	0.20	Cancer 0.014B(a)P equivalency
Chrysene	0.41	0.31	0.25	Cancer 0.013B(a)P equivalency
Benzo(a)pyrene	0.005	0.004	0.003	10 [6] Cancer risk = (34ng/p/d)(70/5yr)[5]

[1] Includes alkylated homologues, specifically C-1, C-2, C-3, C-4 napthalenes; C-1, C-2, C-3 fuorenes; C-1, C-2, C-3 anthracenes/phenanthracenes; C-1, C-2 pyrenes .

[2] With respect to the Basis:

RfD based criteria:	RfD
Napthalene:	(0.04 mg/kg/d x 70kg)/Daily Intake (kg)
Fluorene:	(0.04 mg/kg/d x 70kg)/ Daily Intake (kg)
Anthracene:	(0.30 mg/kg/d x 70kg)/ Daily Intake (kg)

Alkylated homologues assumed to have similar toxicities to the parent compound. Anthracene and phenanthracene were combined because routine chemical analysis does not distinguish between the analogues of these two compounds.

Cancer risk-(q*)-based criteria:	q*[10]
Fluoranthene:	[34ng x (70/5)]/[Daily Intake (g) x 0.02]
Pyrene:	[34ng x (70/5)]/[Daily Intake (g) x 0.13]
Benz(a)anthracene:	[34ng x (70/5)]/[Daily Intake (g) x 0.014]
Chrysene:	[34ng x (70/5)]/[Daily Intake (g) x 0.013]
Benzo(a)pyrene:	[34ng x (70/5)]/[Daily Intake (g)]

One-in-a-million increase in the lifetime upper bound cancer risk adjusted to account for exposures which are expected to last longer than 5 years (70/5 yr). For any sample containing fluoranthene, pyrene, benz(a)anthracene, chrysene, or benzo(a)pyrene, the sum of the individual ratios of the detected levels cannot exceed 1.

References:

1. Yender, R., Michel, J., and Lord, C. (2002). Managing Seafood Safety after an Oil Spill. Seattle: Hazardous Materials Response Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration. 72 pp. Available: http://response.restoration.noaa.gov/book shelf/963 seafood2.pdf

2. Reilly, T.I., and York, R.K. (2001) Guidance on sensory testing and monitoring of seafood for presence of petroleum taint following an oil spill. NOAA Technical Memorandum NOS OR&R 9. Seattle: Office of Response and Restoration, National Oceanic and Atmospheric Administration. 109 pp.

3. Yender, R. (2003). Improving Seafood Safety Management after an Oil Spill. In: *Proceedings of the 2003 International Oil Spill Conference*. 8 pp. Available: http://www.iosc.org/papers/IOSC%202003%20a416.pdf

4. Sloan, C.A., Brown, D.W., Pearce, R.W., Boyer, R.H., Bolton, J.L., Burrows, D.G., Herman, D.P., and Krahn, M.M. (2004). Extraction, Cleanup, and Gas Chromatography/Mass Spectrometry Analysis of Sediments and Tissues for Organic Contaminants. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-59, 47 pp.

5. Bolger, M. and Carrington, C. (1999). Hazard and risk assessment of crude oil in subsistence seafood samples from Prince William Sound: Lessons learned from the Exxon Valdez. In L. Jay Field et al. (eds.). *Evaluating and Communicating Subsistence Seafood Safety in a Cross-Cultural Context: Lessons Learned from the Exxon Valdez Oil Spill.* Pensacola: Society of Environmental Toxicology and Chemistry. Pp. 195-204.

6. Bolger, M., Henry, S.H., and Carrington, C.D. (1996). Hazard and risk assessment of crude oil contaminants in subsistence seafood samples from Prince William Sound. Proc. *EXXON VALDEZ Oil Spill Symposium,* S.D. Rice, R.B. Spies, D.A. Wolfe, and B.A. Wright (eds.). American Fisheries Symposium Vol. 18, pp. 837-843.

7. Bolger, M. and Carrington, C. (1999). Estimation of Risk Associated with consumption of Oil-Contaminated Fish and Shellfish by Alaskan Subsistence Fishermen using a Benzo[a]pyrene Equivalency Approach. In L. Jay Field et al. (eds.). *Evaluating and Communicating Subsistence Seafood Safety in a Cross-Cultural Context: Lessons Learned from the Exxon Valdez Oil Spill. Pensacola: Society of Environmental Toxicology and Chemistry. Appendix 3: Report of the Quantitative Risk Assessment Committee, Center for Food Safety and Applied Nutrition, U.S. food and Drug Administration,* 9 August 1990, pp. 295-304

8. The RfD value is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL or benchmark dose, with uncertainty factors generally applied to reflect limitations of the data used.

9. Slope factor values represent an upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg-day, is generally reserved for use in the low-dose region of the dose-response relationship, that is, for exposures corresponding to risks less than 1 in 100.

10. US Environmental Protection Agency (USEPA). 2000. Guidance for assessing contaminant data for use in fish advisories, Volume 2: Risk assessment and fish consumption limits, Third Edition. EPA 823/B/00/008. Washington, DC: Office of Science and Technology, USEPA.

Received(Date): Fri, 28 May 2010 15:15:33 -0400
From: Beth Dieveney <Beth.Dieveney@noaa.gov>
Subject: BP Oil Dispersants
To: DWH leadership <DWH.Leadership@noaa.gov>
4distribution-1.doc

Information on Dispersant make-up.

--
Beth Dieveney
NOAA Program Coordination Office
Office of the Under Secretary
14th & Constitution Ave., NW, Room 5811
Washington, DC 20230

phone: [redacted]
cell: [redacted]
fax: [redacted]

The following list of chemicals has been developed for distribution by EPA.

Item	CAS Registry Number	Chemical Name (TSCA Inventory)
1	57-55-6	1,2-Propanediol
2	111-76-2	Ethanol, 2-butoxy-
3	577-11-7	Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1)
4	1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate
5	9005-65-6	Sorbitan, mono-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs.
6	9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs
7	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-
8	64742-47-8	Distillates (petroleum), hydrotreated light

Received(Date): Fri, 28 May 2010 17:12:49 -0400
From: Linda belton <Linda.Belton@noaa.gov>
Subject: FW: Pre-brief at 9:05 on Saturday
To: dwh.staff@noaa.gov, 'Monica Medina' <Monica.Medina@noaa.gov>,'David Kennedy' <David.Kennedy@noaa.gov>,'Dave Westerholm' <Dave.Westerholm@noaa.gov>,"'Gray, John'" <John.Gray@noaa.gov>,'Margaret Spring' <Margaret.Spring@noaa.gov>,'Sally Yozell' <Sally.Yozell@noaa.gov>
Cc: 'Jen Pizza' <Jen.Pizza@noaa.gov>,"'Jacqueline J. Rousseau'" <Jacqueline.J.Rousseau@noaa.gov>,'Adele Stevens' <Adele.Stevens@noaa.gov>

From: McGrath, Shaun L. [mailto:Shaun L. McGrath@who.eop.gov]
Sent: Friday, May 28, 2010 5:10 PM
To: McGrath, Shaun L.; Belton, Linda; Monica Medina; heather.smith1@dhs.gov; Tennyson, Stephanie L; Pallone.Sarah@epamail.epa.gov; Lori Faeth; Kayyem, Juliette; Murk, David CDR; Moilanen, Stephen S.; Mark.G.Moland@uscg.mil; Tate, Gail; Munoz, Cecilia
Subject: Pre brief at 9:05 on Saturday

All,

Draft agenda for the pre-call tomorrow is below. Please let me know if there are any changes.

Saturday, May 29 Call with Governors

9:05 a.m. pre-brief; 9:15 Governors

[redacted]

HOST Pin [redacted] – Speakers

[Guest Pin [redacted]]

Please let me know if there are any changes to the speakers below. Also, please be prepared to cover the action items that came up on yesterday's call.

<u>DRAFT AGENDA</u>

Call with Governors – 9:05 a.m. pre-brief; 9:15 Governor

· Opening remarks (Valerie Jarrett)

· Observations and Trajectory – **Monica Medina and David Kennedy, Medina, NOAA**

o NOAA will provide the latest observations and trajectories

· Situation &Leak Stabilization Update – **RADM Peter Neffenger, NIC**

· Operations Report – **RADM Mary Landry, UAC**

o Response Plans and Boom

· EPA Update – **EPA Dep Admin Bob Perciasepe**

o EPA – Bob P. said we would get the talking points on dispersants out to the Governors today.

· Interior Update – **Tom Strickland**

· Open discussion and Q&A with Governors and state officials

· Next call – 9:15 a.m. EDT (8:15 CDT) Saturday, May 29, 2010

·

Received(Date): Fri, 28 May 2010 17:13:17 -0400
From: Helen Golde <Helen.Golde@noaa.gov>
Subject: [Fwd: Unified Command Report]
To: John Rapp <John.Rapp@noaa.gov>
Cc: Brian Pawlak <Brian.T.Pawlak@noaa.gov>,Rebecca Chiampi <Rebecca.Chiampi@noaa.gov>

John-- In reference to getting info on the ORR website, it has come to our attention the Deepwater Horizon response website (see links below) is posting wildlife info and tables. This information doesn't have any of the context and additional info that our stuff has. It really would really be great if we could have a wildlife section of the ORR website to provide more context and info. Note that FWS is also doing this already (see additional link below). Right now wildlife stuff on ORR website is buried in a long narrative, instead of a clear location (which NMFS and OPR could also link to).

Thanks for anything you can do.
-- Helen

-------- Original Message --------

Subject: Unified Command Report
Date: Fri, 28 May 2010 16:51:21 -0400
From: Alexis Gutierrez <Alexis.Gutierrez@noaa.gov>
To: Helen Golde <Helen.Golde@noaa.gov>

http://www.deepwaterhorizonresponse.com/posted/2931/FWNumbers_WEB_28May_Final.571947.pdf
<http://www.deepwaterhorizonresponse.com/go/doctype/2931/55963>
http://www.fws.gov/home/dhoilspill/index.html

Helen M. Golde
Deputy Director
Office of Protected Resources
NOAA Fisheries Service
301 713 2332 x 108

Received(Date): Fri, 28 May 2010 17:22:40 -0400
From: Monica Medina <Monica.Medina@noaa.gov>
Subject: Fw: BP Oil Dispersants
To: "'john.rapp@noaa.gov'" <John.Rapp@noaa.gov>,"'KSarri@doc.gov'" <KSarri@doc.gov>,"'John.Oliver@noaa.gov'" <John.Oliver@noaa.gov>,"'usha.varanasi@noaa.gov'" <Usha.Varanasi@noaa.gov>,"'Steve.Murawski@noaa.gov'" <Steve.Murawski@noaa.gov>,"'steven.wilson@noaa.gov'" <Steven.Wilson@noaa.gov>,"'lauren.b.lugo@noaa.gov'" <Lauren.B.Lugo@noaa.gov>,"'nancy.thompson@noaa.gov'" <Nancy.Thompson@noaa.gov>
4distribution-1.doc

Pls distribute as needed

----- Original Message -----
From: Beth Dieveney <Beth.Dieveney@noaa.gov>
To: DWH leadership <DWH.Leadership@noaa.gov>
Sent: Fri May 28 15:15:33 2010
Subject: BP Oil Dispersants

Information on Dispersant make-up.

--
Beth Dieveney
NOAA Program Coordination Office
Office of the Under Secretary
14th & Constitution Ave., NW, Room 5811
Washington, DC 20230

phone: [redacted] B6 Privacy
cell: [redacted] B6 Privacy
fax: [redacted] B6 Privacy

The following list of chemicals has been developed for distribution by EPA.

Item	CAS Registry Number	Chemical Name (TSCA Inventory)
1	57-55-6	1,2-Propanediol
2	111-76-2	Ethanol, 2-butoxy-
3	577-11-7	Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1)
4	1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate
5	9005-65-6	Sorbitan, mono-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs.
6	9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs
7	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-
8	64742-47-8	Distillates (petroleum), hydrotreated light

Received(Date): Sat, 29 May 2010 08:46:48 -0400
From: "Christopher.S.Moore" <Christopher.S.Moore@noaa.gov>
Subject: ICC Report _ May 29, 2010
To: Deepwater.HorizonDist@noaa.gov
may 29 slb.pdf

FOR OFFICIAL USE ONLY / NOT FOR PUBLIC RELEASE

CAPT Christopher S. Moore, NOAA

Director, NOAA Homeland Security Program Office

Office: (301) 713 3310 x 129

Fax: (301) 713 1641

Cell: [redacted]

E mail: *christopher.s.moore@noaa.gov*

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through COB 28 May 2010

- International Affairs has coordinated a meeting with Cuban officials for Tuesday, 01 June @ 3pm and a video conference with the Bahamians on Thursday, 03 June @ 3pm.
- A new fisheries closure area became effective yesterday at 6 PM Eastern Time. The new closure boundary was extending the eastern and southern boundaries of the previous closure area.
    - The new closure measures 60,683 sq mi (157,169 sq km), which is about 25% of the GOM EEZ.

NOAA Assets

- People
    - Unified command post - Captain Mark Pickett will relieve LCDR Demian Bailey on Saturday as Research Chief of Operations/Platforms Czar. LTJG Chamberlain enroute to support.
    - SST Michael Allen from NOAA ship PISCES will perform technical support on the M/V Ryan Chouest for oil spill monitoring after a request from UC.

- COASTAL CONTAMINATION ASSESSMENT ACTIVITIES
    - Florida Keys Shallow Water Coral Field Team has deployed to the Fl Keys and is composed of 2 FTEs and 2 contract personnel.
    - Chandeleur Dolphin Tissue Sampling Team composed of 3 contract personnel on team and is deployed to Chandeleur Sound
        - Yesterday, a joint NCCOS and NMFS Southeast Fisheries Science Center team collected tissue samples from 3 dolphins in Chandeleur Sound, bringing the total samples up to 10 for the week. The team focused on northeast end of the Sound and no oil was observed. None of the dolphins encountered showed evidence of oiling. The team will continue sampling in Chandeleur Sound on Friday and then return home on Saturday.

- MARINE CONATAMINATION ASSESSMENT ACTIVITIES
    - Plume Mapping & Dispersant Efficacy 1 FTE on team, deployed to sea near the *Deepwater Horizon* site
    - An NCCOS biologist is en route to the *R/V Brooks McCall* a vessel contracted by the responsible party (BP) to characterize the water column in the vicinity of the main release in order to inform responders and monitor dispersant effectiveness. The ship is scheduled to depart Port Fourchon on Saturday May 29.

NOAA Aircraft Operations Summary

- May 27 Flight totals NOAA Aircraft logged 17.3 Hours
- May 28 scheduled Flights NOAA Aircraft have 13 flight hours scheduled for Multispectral scanning and coastal mapping & photography
- Total flight time to date is 303.4 hrs
- May 28 Space A status 2

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through COB 28 May 2010

- Successful P-3 flight yesterday with Videographer and print photographer were aboard the P-3 yesterday. N42RF dropped AXBT, ACTD, and dropsondes. And CAPT Kearse and Dr.
- Nick Shay (U. of Miami) did interviews with the local Fox affiliate and a freelance writer for Nature magazine and other publications.

NOAA Ship Operations Summary

- NOAA Ship Gordon Gunter
  - reporters and photographers from NYT, CNN, AP, and the Times-Picayune visited the ship while u/w yesterday.
  - Preliminary data results from the acoustic survey are beginning to circulate

- NOAA Ship Thomas Jefferson
  - Alongside conducting repairs and media interview
  - Staging for upcoming acoustic and water sampling

- NOAA Ship Pisces & NOAA Ship Oregon II alongside in a repair status

NOAA Partners

- Gliders
  - There are 6 gliders operating in and around the oil spill area
    - 2 NavO gliders deployed from the NOAA Ship Thomas Jefferson
    - Glider RU21 Rutgers/IOOS Glider Zone East
    - Sam USF / IOOS Glider Zone East
    - Waldo Mote Marine Lab / IOOS Glider Zone East
    - Seaglider 515 USM/Irobot (Univ of Washington)
  - All IOOS Glider data is being provided to NDBC in KKYY format for GTS access
  - And additionally an FTP site is being established for data access & download
  - Navy data is being visualized in graphic form, but the data is not yet publicly available.

- HF Radar
  - The May 11th HF Radar proposal submitted to UC and NOAA from IOOS and CODAR is still pending a funding determination. The proposal would establish radar coverage for from South of Fourchon and past the Bird's Foot region of LA and finally to the East side of Bird's Foot.

External Requests

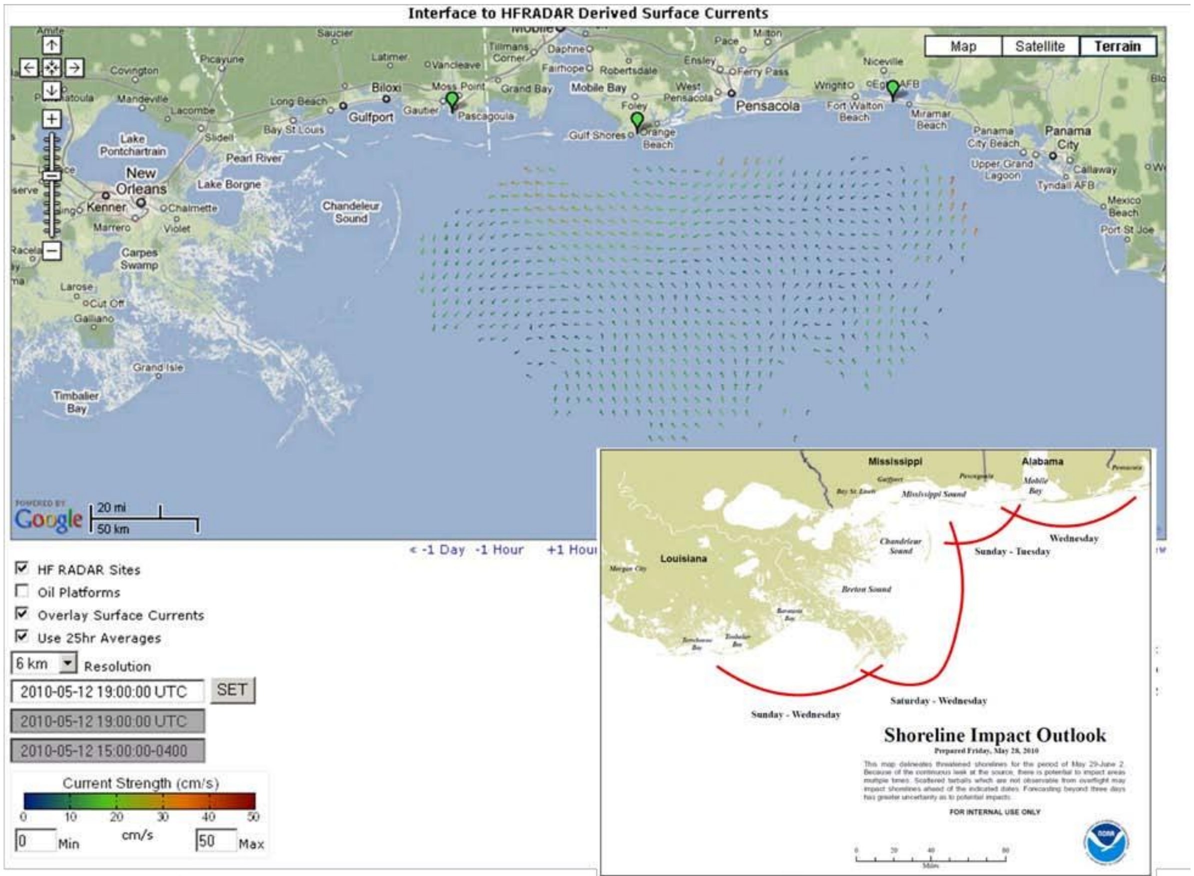
- Requests from GOM fisherman to the Gulf VMS manager are increasing for historical VMS vessel tracks that show where they have fished.

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through COB 28 May 2010

- Received an information request from NORAD/NORTHCOM requesting verification of a submerged plume of oil that was headed to Mobile Bay.
- Received a request from USACE HQ asking if NOAA was going to model the effect of a tropical storm on a submerged oil plume and when would the results be released.

	Command, Information Centers and Staging Areas	**Total NOAA Staff:**
Area Command Post	ROBERT, LA	**10**
Unified Incident Cmd	HOUMA, LA	**29**
Unified Incident Cmd	MOBILE, AL	**19**
Unified Incident Cmd	ST. PETERSBURG, FL	**3**
Unified Incident Cmd	KEY WEST, FL	**4**
Unified Incident Cmd - Source Control	HOUSTON, TX	**0**
Staging Areas		
Venice, LA	Venice, LA	**2**
Pascagoula, MS	Pascagoula, MS	**15**
	TOTAL DEPLOYED NOAA STAFF:	***82***
	Miscellaneous/Various Locations:	23
	Total Deployed NOAA Staff:	***105***

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through COB 28 May 2010



Existing HF Radar coverage w/ insert of Landfall Map

Received(Date): Sat, 29 May 2010 13:48:20 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP GUlf of Mexico Update May 28

Gulf of Mexico Oil Spill Response Update

05/28/2010 – 9:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the sea floor to stop the flow of oil through various strategies;

2. On the surface to minimize impacts of the spill; and

3. Onshore to protect the shoreline and inform the public.

Highlights

Top kill procedure continues.

ξ Shoreline protection efforts redoubled.

ξ Subsea dispersant use continues.

ξ No reports of oil onshore in Mississippi, Alabama, and Florida.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

1. Riser Insertion Tube – riser insertion tool remains staged on the sea floor and is not currently in use. To date, the tool has collected approximately 22,000 barrels of oil.

2. Dispersant injection on the sea floor – approximately 14,000 gallons of dispersant was used subsea today. EPA is allowing subsea application of the currently-used dispersant to continue.

3. "Top Kill" Activities

- Operations continue and are expected to continue for the next 24-48 hours.

- The “top kill” system includes bypass lines, a manifold, and valves through which heavy fluids are being delivered into the BOP. An animated description of the procedure can be found on the Deepwater Horizon Unified Command website at: http://www.deepwaterhorizonresponse.com/go/site/2931/

- Plans and equipment are in place to combine the top kill process with the injection under pressure of bridging material into the BOP to prevent or limit upward flow through the BOP. This procedure has never been performed in 5,000 feet of water.

4. Drilling relief wells

- The first relief well (work being performed by the *Development Driller III*) is at approximately 10,100 feet below sea level. This well was “spudded” on May 2. The liner is cemented and preparing to resume drilling.

- The second relief well (work being performed by *Development Driller II*) is at approximately 8,650 feet below sea level. Drilling began on May 16.

- Both wells are situated approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. It is estimated the total drilling process for each well will take at least 90 days

5. Containment Recovery System

- A Lower Marine Riser Package (LMRP) cap has been fabricated and shipped to the location. This cap is designed to fit directly over the top of the blowout preventer once the broken riser pipe is removed. If needed, the cap will be attached to a riser pipe to convey oil and gas from the well directly to the *Enterprise* drill ship on the surface.

Offshore – Surface Spill Response

Cleanup Vessels – approximately 1,400 response vessels are now deployed (tugs, barges and recovery boats). 93 are skimmers.

Skimming Operations – 7,200 barrels of oily-water mix collected yesterday. Ttotal to date = 280,949 barrels.

Surface Dispersant – Limited surface dispersant was applied yesterday. Over 400,000 gallons of dispersant remain available.

In-Situ Burning – The Unified Command conducted an additional 13 in-situ burns on Thursday. In-situ burning occurs on the surface using special fire-boom that collects surface hydrocarbons which are then burned.

Onshore - Shoreline Protection and Community Outreach

Shoreline Protection – both Coast Guard and BP are redoubling efforts with additional senior operations managers coming into field locations to improve responsiveness and speed cleanup operations. The response organization has been restructured into three main branches - east, west and offshore. Additional forward operating bases and staging areas are being established in western Louisiana.

Shoreline Protection - Boom Report –over 1,800,000 feet of containment boom has been deployed (with an additional 200,000 feet staged). Over 1,500,000 feet of sorbent boom has been deployed (with an additional 1,000,000 feet staged)

Claims - BP has 24 claims offices (across LA., MS., AL., FL.) open to help claimants through the process. **Over 27,500 claims totalling over $37 million have been paid ($17 million in Louisiana).** 15,000 claims are waiting on documentation from claimants. Most claims are for loss of income or wages in commercial fishing, shrimping and oyster harvest, and associated facilities. Note: No person asserting a claim or receiving payment for interim benefits will be asked or required to sign a release or waive any rights to assert additional claims, to file an individual legal action, or to participate in other legal actions associated with the Deepwater Horizon incident. The contact number for claims is (800) 440-0858. In person claims can be filed at office locations listed below. Claims can also be filed online at: http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138

State specific websites established - BP today announced four informational web sites designed to offer state-specific (LA., MS., AL., FL) oil spill information to residents of communities affected by the Deepwater Horizon oil spill. Residents are encouraged to visit these sites frequently and sign up for the mailing list to receive the most current information about the spill response. These sites are dedicated to providing information about activities and events most important to residents of each state.

Alabama: www.alabamagulfresponse.com
Florida: www.floridagulfresponse.com
Louisiana: www.louisianagulfresponse.com
Mississippi: www.mississippigulfresponse.com

Independent Claims Mediator established - BP is appointing an Independent Mediator so that we have as fair a process as possible for everyone in the Gulf region. BP has always said will pay legitimate claims for loss and damage caused by the spill, and we're committed to paying claims promptly. In those cases in which a claimant and BP cannot agree on resolution of a claim, the mediator is a way for them to get an independent review.

$500 Million for 10-year Research Program to Study Spill Impacts – BP is contributing $500 million over 10 years to fund an open research program studying the impact of the Deepwater Horizon incident, and its associated response, on the marine and shoreline environment of the Gulf of Mexico.

BP Provides $70 million in Tourism Grants to States – BP has made $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism.

$25 Million Block Grants to 4 States – On May 4, BP announced it would provide Louisiana, Florida, Mississippi and Alabama $25 million each to accelerate implementation of the States' Area Contingency Plans.

"Vessels of Opportunity" Program – Over 5,000 contracts have been signed and nearly 1,000 vessels are currently active. Community Outreach Centers are working with the contractors to ensure they have the appropriate training.

Volunteers and Training – 15,000 volunteers are registered. BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Volunteers are being trained in five different modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

Wildlife Activities – Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

Summary of Regional Operations and Outreach

Louisiana Sites:

- Robert – Unified Area Command
  - Houma – Incident Command Post
    - Pointe A La Hache – Community Outreach Center
    - Venice – Community Outreach Center, Staging Area
    - Grand Isle – Staging Area
    - Port Fourchon – Staging Area
    - Cocodrie – Staging Area
    - Shell Beach – Staging Area
    - Slidell – Staging Area
    - St. Mary – Staging Area
    - Amelia – Staging Area
  - Belle Chasse – **Claims Office**

	2766 Belle Chasse Hwy Belle Chasse, LA 70037
	Cut Off – **Claims Office** Tarpon Heights Shopping Center Unit 2 16263 E. Main Street Cut Off, LA 70345
	Grand Isle – **Claims Office** 3811 LA 1 Grand Isle, LA 70358
	Hammond – **Claims Office** Worley Operations Center 303 Timber Creek Hammond, LA 70404
	Houma – **Claims Office** Plaza Caillou Shopping Center 814 Grand Caillou Road Suite 2 & 3 Houma, LA 70363
	New Orleans – **Claims Office** 4375 Michoud Blvd New Orleans, LA 70461
	Slidell – **Claims Office** 2040 Gause Blvd., Suite 10 Slidell, LA 70461
	St. Bernard – **Claims Office** 1345 Bayou Rd Saint Bernard, LA 70085
	Venice – **Claims Office** 41093 Hwy LA 23

	Boothville, LA 70038

Mississippi Sites:	Pascagoula – Community Outreach Center, Staging Area
	Biloxi – Community Outreach Center, Staging Area
	Waveland – Community Outreach Center
	Pass Christian – Staging Area
	Bay St. Louis – **Claims Office** 1171 Highway 90 Bay St. Louis, MS 39520
	Biloxi – **Claims Office** 920 Cedar Lake Rd, Suite K Biloxi, MS 39532
	Pascagoula – **Claims Office** 5912 Old Mobile Hwy Suite 4 Pascagoula, MS 39563

Alabama Sites:	Mobile – Incident Command Post, Community Outreach Center
	Theodore – Staging Area
	Orange Beach – Staging Area
	Dauphin – Staging Area
	Bayou LaBatre – **Claims Office** 13290 N. Wintzell Avenue Bayou LaBatre, AL 36509

Foley – **Claims Office** (Orange Beach/Gulf Shores/Bon Secour) 1506 North McKenzie Street (HWY 59), Suite 104 Foley, AL 36535	Gulf Shores / Orange Beach – **Claims Office** 24039 Perdido Beach Blvd Suite 1 Orange Beach, AL 36561

Karen St John

BP America

Sr. Director, Regulatory Affairs

[redacted] B6 Privacy

Received(Date): Sat, 29 May 2010 09:51:19 -0400
From: Joe Inslee <Joe.Inslee@noaa.gov>
Subject: [Fwd: Prep for NRT Meeting, May 29, 2010]
To: NOAAHQ.Leadership@noaa.gov, Policy.Contacts@noaa.gov, dwh.staff@noaa.gov,PCO.Contacts@noaa.gov, KSarri@doc.gov
NRT Agenda 29 May 1100 mtg.doc

Below and attached are prep materials for the May 29, 11 AM NRT call

For Official Use Only

May 29, 2010
National Response Team Meeting at 1100:

Call in Number: 1-[redacted] and participation pin is [redacted]
Please dial in 15 minutes before the call for a roll call starting at 10-minutes before the scheduled start time.
/
/NOAA SSC Charlie Henry will be with RADM Landry at the Unified Area Command in Robert, LA. Any detailed or technical questions may be referred to him.

DOC/NOAA Objectives for the Meeting:

1. Convey substantive messages about NOAA involvement in the response.
2. Acquire current status of response, coordination and outreach efforts.
3. Answer questions on NOAA activities and products.

The agenda for the NRT meeting is attached. There are no agenda items assigned to NOAA and the agency does not have a priority message to convey at today's meeting.

The following NOAA products have been distributed to the NRT agencies prior to the meeting:

* Most recent Spot Weather Forecast
* Coastal trajectory prediction for location of surface oil with 72-hour outlook
* Offshore trajectory prediction for location of surface oil with 72-hour outlook
* Shoreline Impact Outlook showing likely new landfalls of oil over the coming 5 days
* Loop Current location relative to oil slick

Overview of NOAA products

* _Weather _
    o NW winds today will switch to the S and SW tonight, increasing the likelihood of additional oil coming to shore over the next several days. Seas will be calm with a light chop. Isolated thunderstorms may disrupt spill operations again late in the day.
* _Coastal Trajectory _
    o Southerly winds will tend to push the oil back onshore with fresh deposits possible on the east side of eh Delta. By mid-week, it is possible that oil could spread to the east, possibly involving the Mobile Bay area and even Pensacola

(see Coastal Impact Outlook).

* _Loop Current with Offshore Trajectory _

  o The northern part of the LC remains separated, and has formed a large clockwise eddy over 100 miles south of the spill site. As a result, any small amounts of oil that may reach this eddy will be moved in a large circular pattern in the middle of the Gulf, and not threaten any shorelines. There is also minimal risk of the LC serving as a significant mechanism to transport oil toward any shorelines and there is no evidence to suggest significant amounts of oil are moving toward the LC. The eddy discussed above will likely re-attach to the Loop Current over the next week or two. Only non-contiguous sheens and scattered tarballs are visible in this eddy.

* _Agenda Item:_ Polling of NRT Secretaries

No priority messages have been identified for NOAA to contribute.

--
William G. Conner, Ph.D.
Chief, HAZMAT Emergency Response Division
NOAA Office of Response and Restoration
Phone: [redacted] (190)
Cell: [redacted]

--
Joe Inslee
Policy/Outreach Assistant
Assessment and Restoration Division
NOAA Office of Response and Restoration
1305 East-West Highway SSMC 4, Rm. 10219
Silver Spring, MD 20910 Office [redacted] ext. 202
Cell [redacted]
Fax [redacted]

BP Oil Spill Response – Gulf of Mexico Incident
National Response Team (NRT) Phone Conference Meeting

AGENDA

Conference call-in phone number: 1-[redacted] and participation pin is: [redacted]
May 29, 2010 11:00 AM EDT

Objective: Secretary Napolitano and the National Incident Commander (NIC) have requested a conference call with NRT Agency Heads (Secretary Level) today at 11:00 AM EDT. This meeting should last no longer than 30 minutes.

Audience: NRT Agency Heads (Secretary Level) plus one member. Regional Response Team IV and VI Co-Chairs may call in.

May 29, 2010

Call In	
Roll Call	USCG
Significant Activities	NIC
SubSurface Response Status	
On Water Recovery Status	
Shoreline Response Status	
Weather/Oil Trajectories	
Polling of NRT Secretaries	USCG
Communication Update	OPA
Legal Affairs Update	OGC
Intergovernmental Affairs Update	IGA
Congressional Affairs Update	OLA
Secretary's Closing Remarks	S-1
Meeting Adjourned	

UNCLASSIFIED

Received(Date): Sat, 29 May 2010 15:12:24 -0400
From: John Oliver <John.Oliver@noaa.gov>
Subject: Deepwater Horizon MC252 LMR report for May 29
To: _HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>, John.Oliver@noaa.gov
Mammal_and_Turtle_Stranding_Report_28_May-FINAL.doc

Fishery Closure

- There was no change to the closed area for May 29
- The closed area from May 28th remains in effect
  - The closed area measures 60,683 sq mi (157,169 sq km), which is about 25% of the GOM EEZ
  - The map of the current closed area is attached (same map from yesterday's report)

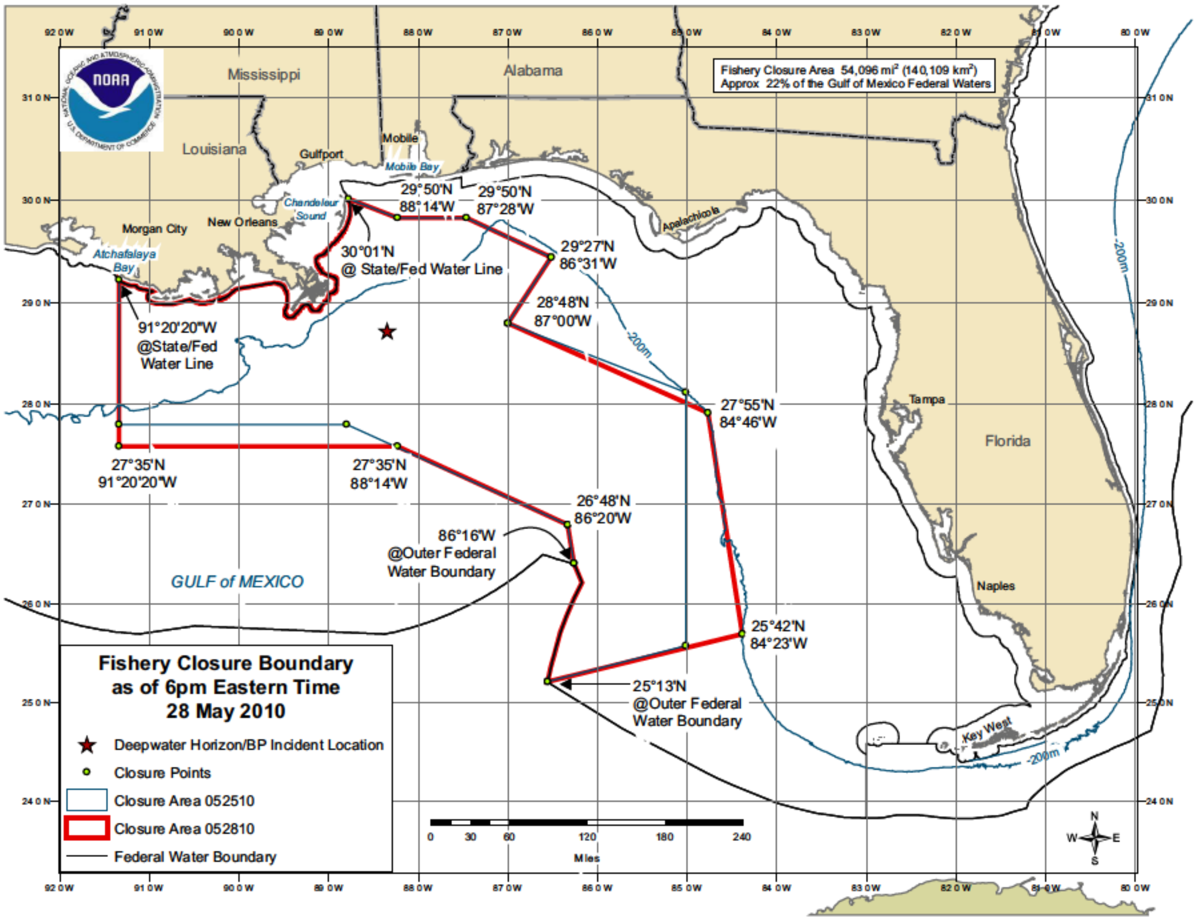
Seafood Inspection

- We are reviewing a new draft re opening protocol today with changes requested by both EPA and FDA. FDA changed one of the criteria to a more appropriate level in that it is based on two year consumption data and not five. It is less stringent and offers far more flexibility.
- EPA proposed changes at the same time that were not included in the draft protocol OMB circulated last night but came from EPA in a separate email. DOC is working with OMB, helping NOAA, make it clear that we will review EPA water quality data that is available or if practicable or whenever possible some qualifier that means we will try but not be required to review EPA's water quality data from a particular site before we re open an area. We are seeking flexibility here as well.

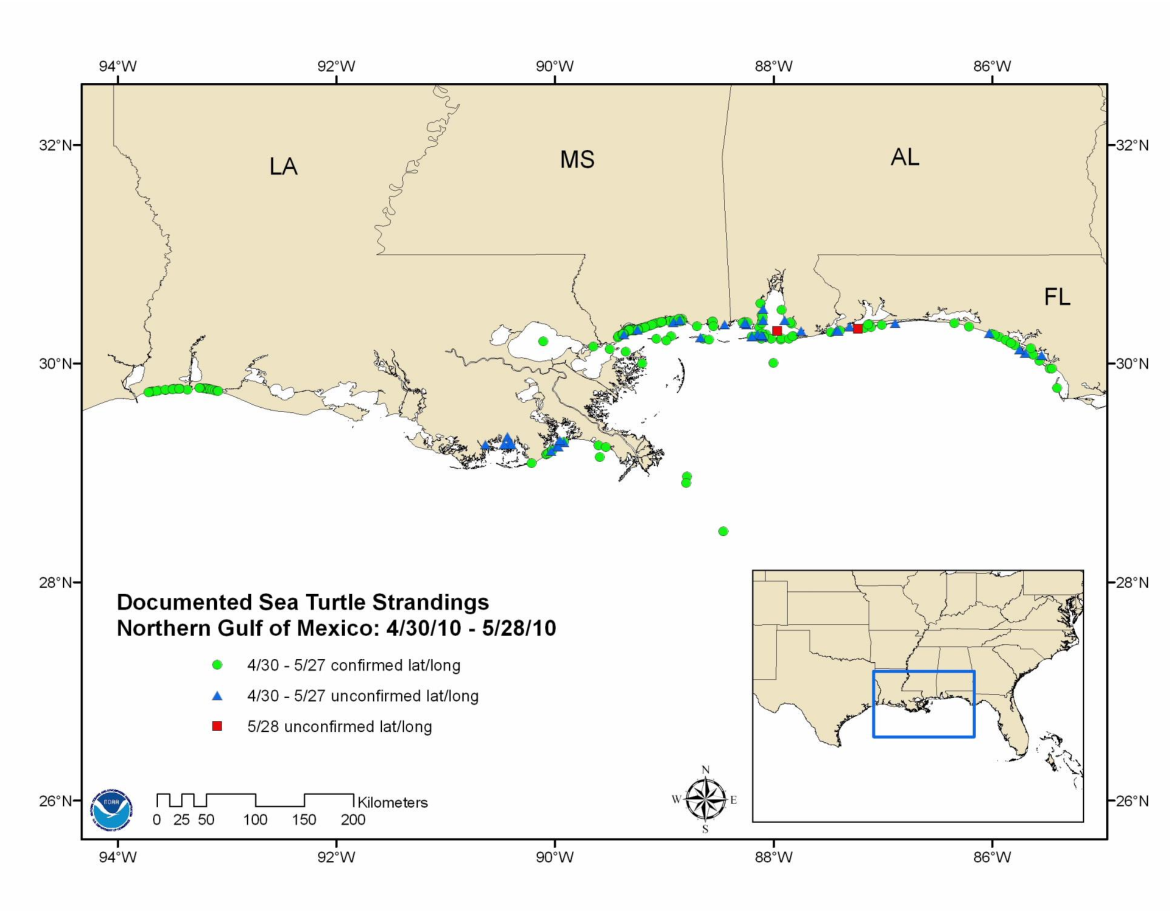
Marine Mammal and Turtle Health and Stranding Reports

- The updated report is attached along with the current turtle stranding map

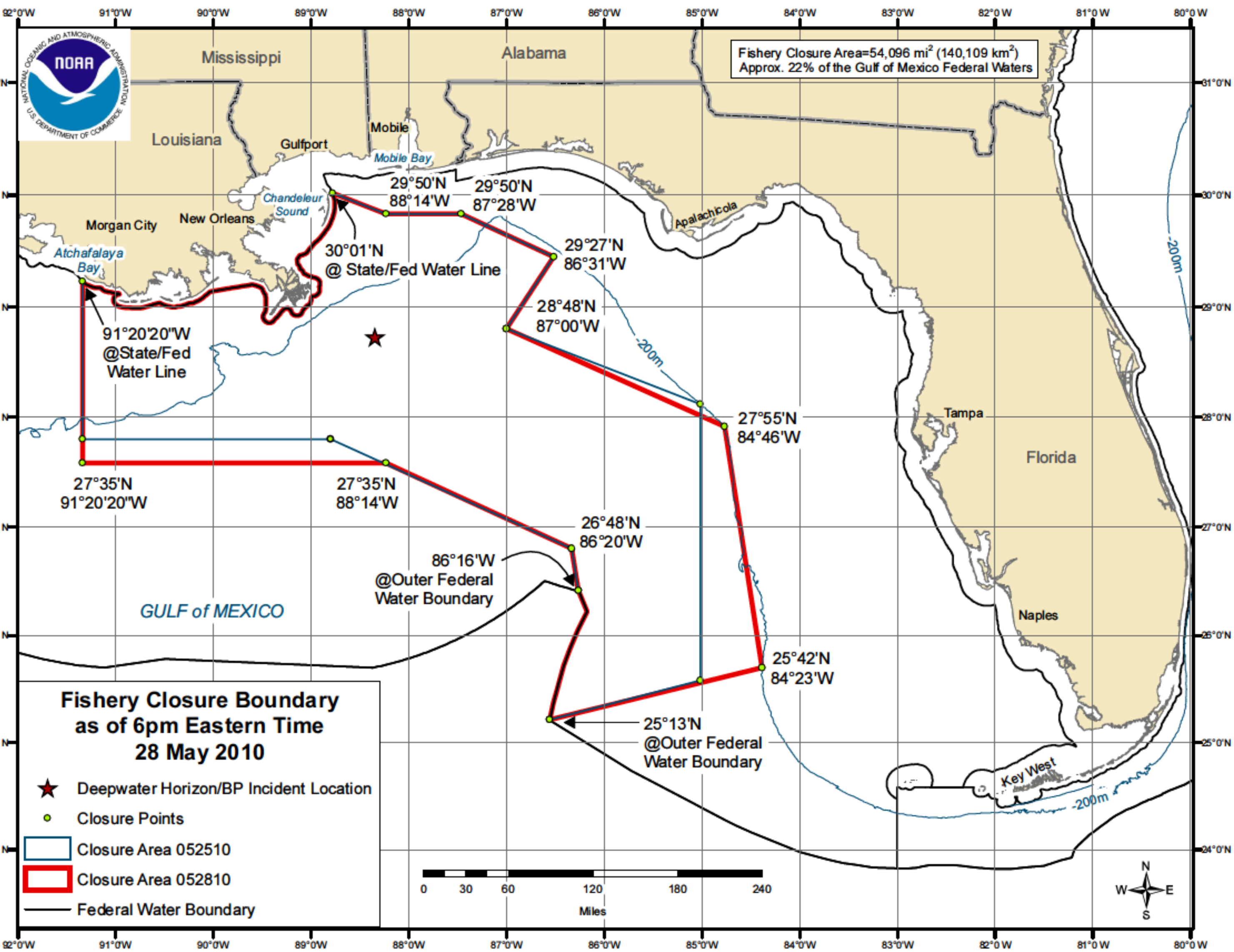
---



Fishery Closure Area 54,096 mi^2 (140,109 km^2)
Approx 22% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Louisiana
Florida
Mobile
Mobile Bay
Gulfport
Chandeleur Sound
New Orleans
Morgan City
Atchafalaya Bay
Apalachicola
Tampa
Naples
Key West
GULF of MEXICO
-200m
29°50'N 88°14'W
29°50'N 87°28'W
30°01'N @ State/Fed Water Line
29°27'N 86°31'W
28°48'N 87°00'W
91°20'20"W @State/Fed Water Line
27°55'N 84°46'W
27°35'N 91°20'20"W
27°35'N 88°14'W
26°48'N 86°20'W
86°16'W @Outer Federal Water Boundary
25°42'N 84°23'W
25°13'N @Outer Federal Water Boundary
Fishery Closure Boundary as of 6pm Eastern Time 28 May 2010
Deepwater Horizon/BP Incident Location
Closure Points
Closure Area 052510
Closure Area 052810
Federal Water Boundary
0 30 60 120 180 240
Miles
N W E S



Document ID: 0.7.19.2043



Document ID: 0.7.19.2043.1

Update through 28 May 2010 (as of 1800)

Marine Mammal and Sea Turtle Health and Response

Noteworthy Developments During this Reporting Period:

- Increase of 2 turtle and 1dolphin strandings

* For this event, a true stranding is defined as a turtle that washes ashore dead or debilitated or is found floating dead or debilitated in the course of non-directed turtle surveys. Turtles observed and/or captured during directed sampling efforts are not categorized as strandings.

Sea Turtles:

240 total sea turtles verified to date within the "designated spill area" (increase of 2 from May 27)

- 237 Stranded (increase of 2 from May 27)
  - 224 of the stranded were found dead (increase of 2 from May 27)
    - 1 stranded dead and oiled (no change from May27)
  - 3 recovered alive but died in care (no change from May 27)
  - 1 turtle released alive (no change from May 27)
  - 9 live turtles in rehabilitation (no change from May 27)

- 3 collected during directed sampling efforts (no change from May 27)
  - 3 live turtles in rehabilitation (no change from May 27)

Turtle Necropsy Status (of the 224 dead stranded and 3 that died in rehab):

- 7 assessed and unable to perform necropsies (i.e. advance decomposition) (no change from May 27)
- 17 partial necropsies (e.g. due to scavenging or autolysis) (no change from May 27)
- 50 full necropsies performed (no change from May 27)
- 44 carcasses not collected due to decomposition state or unable to recover but marked and/or buried (no change from May 27)
- 109 carcasses to be necropsied, if decomposition stage warrants (increase of 2 from May 27)
- Of the 67 full or partial necropsies completed, the two primary considerations for the cause of these strandings are forced submergence or acute toxicosis.

Information on Signs of Oiling:

- To date, visible evidence of oil has been documented externally on 1 dead stranded sea turtle that has been examined.
- To date, visible evidence of oil has been documented externally on 3 live collected sea turtles that have been examined.

Historical Strandings:

- The total number of sea turtle strandings that we have documented from the Louisiana/Texas border through the Florida panhandle from April 30th through May 27th is 237.

- This is much higher than the number of turtle strandings that have been documented in recent years in Louisiana, Mississippi, and Alabama during this time frame (combined range of 4-30 for LA, MS, and AL)
    - Overall Northern Gulf range for recent years has been 18-46.
    - From 2005 – 2009 the number of turtle strandings for the month of May has ranged from 1 to 15 in Louisiana
    - From 2005 – 2009 0 to 13 in Mississippi
    - From 2005 – 2009 1 to 15 in Alabama.
    - In the Florida panhandle, from 2003 – 2007, the number of strandings in May has ranged from 13 to 37.

- There has been an increase in awareness and human presence in the northern Gulf of Mexico, which likely has resulted in some of the increased documentation of stranded turtles; however, we do not believe this factor fully explains the increase.

Marine Mammals:

- 25 dolphins have been verified to date within the "designated spill area" (an increase of 1 from May 27).
    - All 25 were dead stranded dolphins (an increase of 1 from May 27)

Dolphin Necropsy Status:

- 9 assessed and unable to perform necropsies (e.g. advanced decomposition) (increase of 1 from May 27)
- 7 partial necropsies performed (e.g. due to scavenging or autolysis) (no change from May 27)
- 3 full necropsies performed (no change from May 27)
- 6 Verified strandings but animals not collected due to stage of decomposition or unable to recover (no change from May 27)
- 0 Carcasses to be necropsied, if decomposition stage warrants

Information on Signs of Oiling:

- One of the dolphins had evidence of external oil on its tongue and body and therefore is classified as oiled. Since the carcass was first reported in the water/oil line on the oiled beach, we are unable at this time to determine whether the animal was externally covered in oil post mortem when the carcass came on shore or was oiled prior to death.

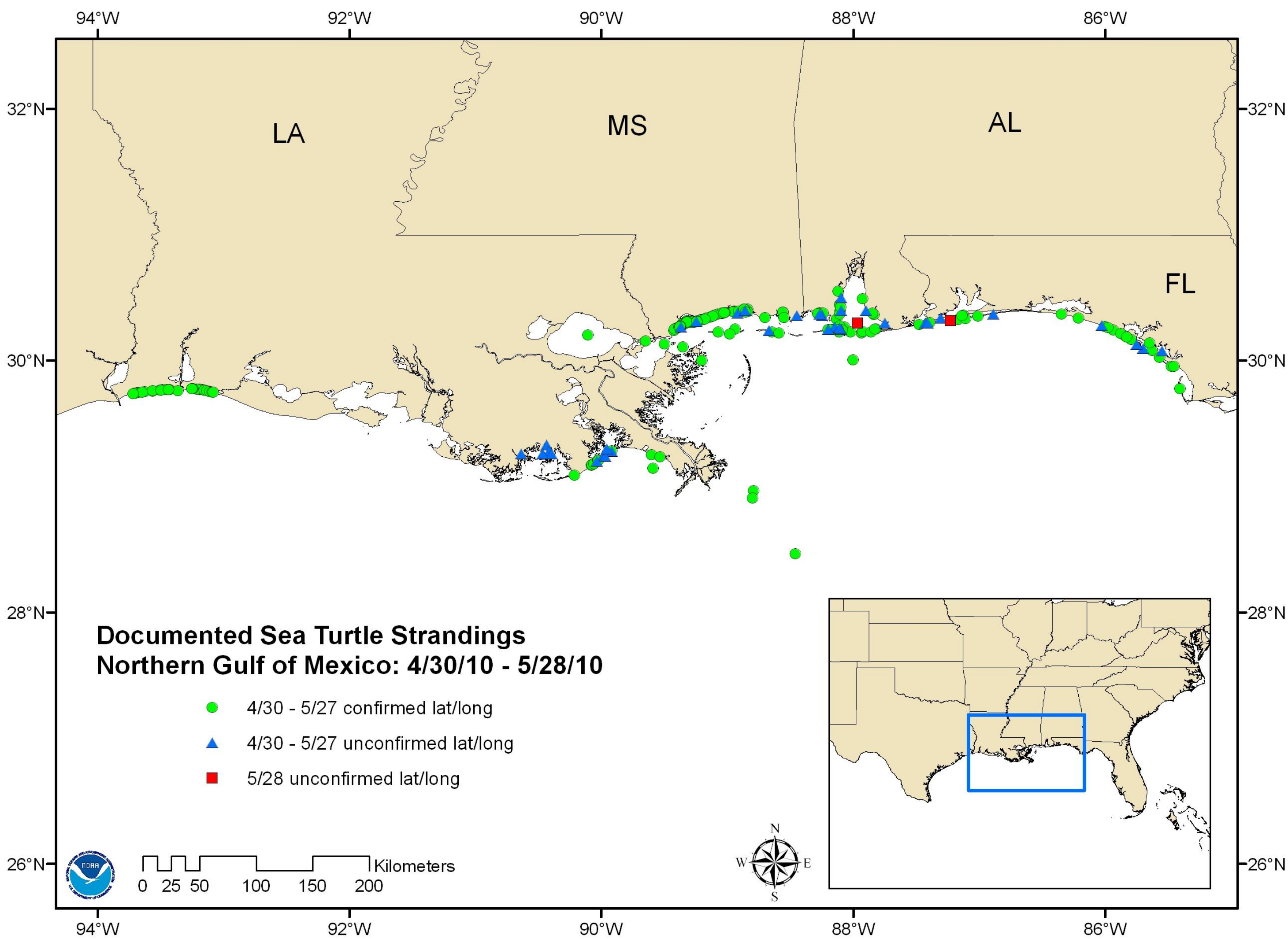
Update through 28 May 2010 (as of 1800)

Historical Strandings

- Since April 30th, the stranding rate of dolphins in Louisiana is higher than the historic numbers, but this may be a reflection of increased detection and reporting and the lingering effects of the earlier observed spike in strandings.

Summary of Action Plan Items:

- At least one BP affiliated observer will accompany vessels departing today to remove and dispose of a large mat of boomed oiled Sargassum off the Alabama coast. Information received from this observer upon return will guide the protocols and observer plans for this clean-up activity should it continue.
- Working with Jessica White from ORR to evaluate the risk of sea turtle take associated with oil removal from skimmer operations to deploy observers on specific vessels that pose the highest risk. Team members are enroute to LA to re-start the on-water dedicated turtle search efforts this week. The team will be led by the Florida Fish and Wildlife Conservation Commission and also includes staff from NMFS, Georgia DNR, and BP contracted staff from In-water Research Group (an FFWCC sea turtle permit holder). One FWC vessel and two VOO will be used. Logistics for the operation, including transport of captured turtles to Audubon Aquarium are in place.
- Planning is ongoing to transfer the five live turtles currently in rehab at IMMS to Florida aquaria as early as tomorrow. USFWS, NMFS, and FFWCC are coordinating with USCG to bring the animals to SW Florida via USCG helicopter. Two of the turtles are likely ready for release after we re-confirm their health status following transport. FFWCC will coordinate the release under permit from USFWS. The other three turtles will need additional time in rehab. These turtles are being relocated to free up IMMS to receive oiled turtles - they are the only de-oiling facility in MS.



Document ID: 0.7.19.2043.3

Received(Date): Sat, 29 May 2010 18:20:55 -0400
From: Beth Dieveney <Beth.Dieveney@noaa.gov>
Subject: [Fwd: Fw: BP Oil Dispersants]
To: Lois Schiffer <Lois.Schiffer@noaa.gov>,"'John.Rapp@noaa.gov'" <John.Rapp@noaa.gov>
4distribution-1.doc

email trail regarding BP oil dispersant

The list is a combined list for both Corexit 9500 and Corexit 9527. At this point, a detailed formula will not be available from EPA until May 29th, and that list would be subject to CBI rules. We are working on getting the detailed list to you faster and without the CBI limitation.

-------- Original Message --------

Subject: Fw: BP Oil Dispersants
Date: Mon, 24 May 2010 17:55:11 +0000
From: Robert Haddad <Robert.Haddad@noaa.gov>
Reply-To: Robert.Haddad@noaa.gov
To: Beth Dieveney <Beth.Dieveney@noaa.gov>

This list of ingredients is partial and for both corexit products. I'll send you the next email. Bob

Robert Haddad PhD
NOAA/ORR
Chief ARD
[redacted] B6 Privacy

Original Message
From: Jamon.Bollock@noaa.gov
Date: Mon, 24 May 2010 12:15:19
To: Robert.Haddad<Robert.Haddad@noaa.gov>
Cc: 'Brian Julius'<Brian.Julius@noaa.gov>; 'William Conner'<William.Conner@noaa.gov>; 'Lois Schiffer'<Lois.Schiffer@noaa.gov>; <Craig.R.O'Connor@noaa.gov>
Subject: Re: BP Oil Dispersants

Bob,

EPA has provided me with the attached list of component chemicals. This list is publicly cleared and not subject to CBI rules. I am working on obtaining a more detailed formula, but it appears that EPA's regulations are cumbersome. I will let you know when there is news on the front. Please let me know if you have any questions. Thank you.

Jamon

Original Message
From: "Robert.Haddad" <Robert.Haddad@noaa.gov>
Date: Saturday, May 22, 2010 1:53 pm
Subject: RE: BP Oil Dispersants
To: 'Brian Julius' <Brian.Julius@noaa.gov>, 'Jamon Bollock' <Jamon.Bollock@noaa.gov>
Cc: 'William Conner' <William.Conner@noaa.gov>, 'Lois Schiffer'

<Lois.Schiffer@noaa.gov>, Craig.R.O'Connor@noaa.gov

> Brian and Jamon: Any news yet? I just want to keep others appraised
> of our
> efforts to get this information.
>
> Thanks, Bob
>
> Robert Haddad, Ph.D.
> Chief, Assessment & Restoration Division
> NOAA/Office of Response & Restoration
> Office: [redacted]
> Cell: [redacted]
> www.darrp.noaa.gov
> www.response.restoration.noaa.gov
>
>
>   Original Message
> From: Brian Julius [
> Sent: Friday, May 21, 2010 6:11 PM
> To: Jamon Bollock
> Cc: William Conner; Robert Haddad
> Subject: Re: BP Oil Dispersants
>
> Jamon,
>
> I have heard from both Dr. Conner and Dr. Haddad, and none of us have
>
> received this information to date.
>
>   Brian
>
> Jamon Bollock wrote:
> > Dr. Conner and Mr. Julius,
> >
> > Lois Schiffer asked me to find out whether OR&R has received a list
> of
> > the constituent chemical ingredients in the dispersants being used
> by
> > BP. EPA informed me that the maker of the chemicals had agreed to
> > allow the information to be made public and that EPA's OSWER would
> > provide the list to NOAA. We want to make sure OR&R has the
> > information it needs.
> >
> > Could you please let me know if you've received the list and whether
>
> > it provides sufficient information? I also sent a message to Dr.
> > Haddad with the same question. Thanks.
> >
> > Jamon
> >
> >
>
>
> _______________________________
> Brian Julius

> Deputy Director
> NOAA Office of Response and Restoration
> N/ORR, SSMC4, Rm. 10110
> 1305 East West Highway
> Silver Spring, MD 20910
> Ph: [redacted]
> Cell: [redacted]
> Fax: [redacted]
> Email: brian.julius@noaa.gov
>
>
>

Beth Dieveney
NOAA Program Coordination Office
Office of the Under Secretary
14th & Constitution Ave., NW, Room 5811
Washington, DC 20230

phone: [redacted]
cell: [redacted]
fax: [redacted]

The following list of chemicals has been developed for distribution by EPA.

Item	CAS Registry Number	Chemical Name (TSCA Inventory)
1	57-55-6	1,2-Propanediol
2	111-76-2	Ethanol, 2-butoxy-
3	577-11-7	Butanedioic acid, 2-sulfo-, 1,4-bis(2-ethylhexyl) ester, sodium salt (1:1)
4	1338-43-8	Sorbitan, mono-(9Z)-9-octadecenoate
5	9005-65-6	Sorbitan, mono-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs.
6	9005-70-3	Sorbitan, tri-(9Z)-9-octadecenoate, poly(oxy-1,2-ethanediyl) derivs
7	29911-28-2	2-Propanol, 1-(2-butoxy-1-methylethoxy)-
8	64742-47-8	Distillates (petroleum), hydrotreated light

Received(Date): Sun, 30 May 2010 07:42:06 -0400
From: "Christopher.S.Moore" <Christopher.S.Moore@noaa.gov>
Subject: Deepwater Morning Reports
To: Deepwater.HorizonDist@noaa.gov
os_forecast_20100601_1200CDT_20100529_1900CDT_rs.pdf
landfall5_29_complete.pdf
Deepwater_Horizon_Report_42.pdf
forecast_20100601_1200CDT_20100529_2100CDT.pdf

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CAPT Christopher S. Moore, NOAA

Director, NOAA Homeland Security Program Office

Office: (301) 713 3310 x 129

Fax: (301) 713 1641

[redacted] B6 Privacy

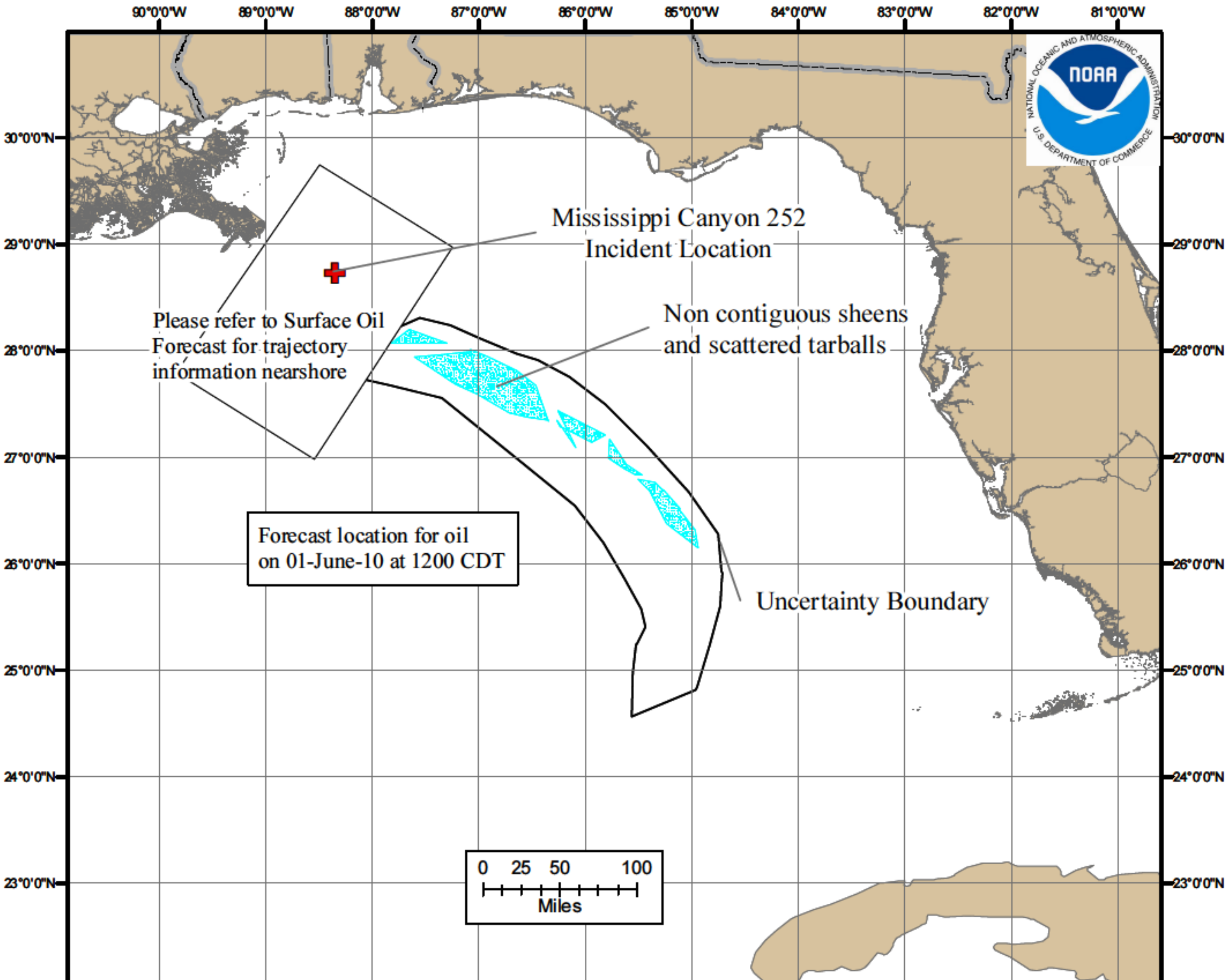
E mail: *christopher.s.moore@noaa.gov*

Offshore
Surface Oil Forecast
Deepwater Horizon MC252

NOAA/NOS/OR&R **Offshore**

Estimate for: 1200 CDT, Tuesday, 6/01/10
Date Prepared: 1900 CDT, Saturday, 5/29/10

Currents were obtained from three models: NOAA Gulf of Mexico, NavO/NCOM, and NC State SABGOM. Each includes Loop Current dynamics. Gulf wide winds were obtained from the gridded NCEP product. The model was initialized from Friday satellite imagery analysis (NOAA/NESDIS). The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization).

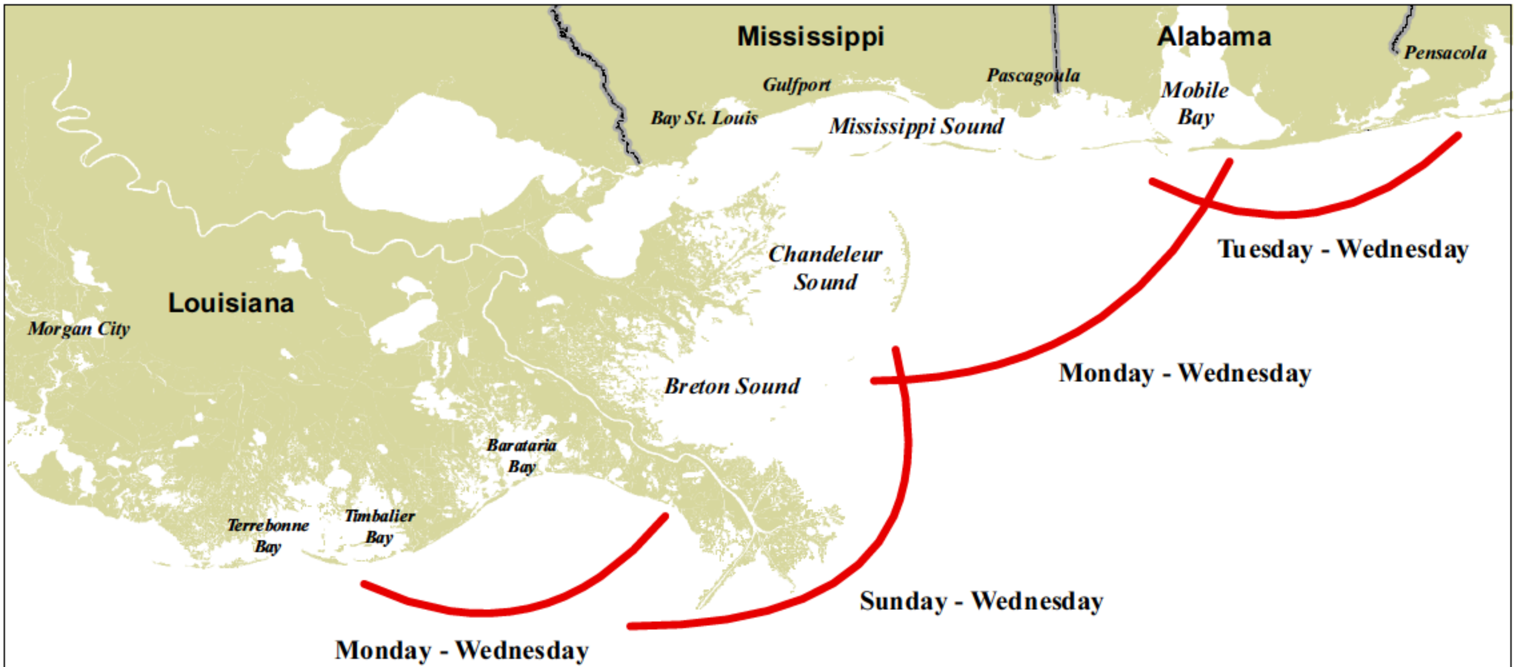


Satellite imagery analysis continues to show a narrow band of oil to the SE of the main slick, extending to approximately 27 degrees N. An overflight to this region reported only non contiguous, colorless sheens continuing in a narrow band as seen in the satellite imagery. Trajectories for remaining observed oil within this region suggest some of these scattered sheens will continue to be entrained into the clockwise eddy that has detached from the Loop Current.

this scale bar shows the meaning of the distribution terms at the current time

Next Forecast:
May 30th PM

Document ID: 0.7.19.2037.1



Shoreline Impact Outlook

Prepared Saturday, May 29, 2010

This map delineates threatened shorelines for the period of May 30 June 2. Because of the continuous leak at the source, there is potential to impact areas multiple times. Scattered tarballs which are not observable from overflight may impact shorelines ahead of the indicated dates. Forecasting beyond three days has greater uncertainty as to potential impacts.

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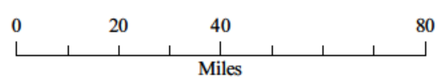


NOAA Emergency Response Division (ERD)
Report # 42: May 29, 2010- 1800 PDT
MC 252 DEEPWATER HORIZON Incident, Gulf of Mexico, Major Spill Incident

Situation Update, Day 40:

After 3 days of trying to kill the well with drilling fluids and debris, BP has conceded that the effort has not been successful in stemming the flow of oil from the ruptured riser. In an early evening press conference, BP said it was unclear why the “top kill” failed but said it was time to move to other options.

The next approach for stopping the well leak is the lower marine riser package approach, or LMRP. The LMRP cap is a newly made version of a device formerly referred to as a "top hat." In this operation BP will cut the bent riser pipe from the blowout preventer and place an engineered cap over the opening. The cap would be connected to the drillship via a riser pipe. The material and equipment required to complete this operation are already in place but the effort is still expected to take four to seven days. BP believes that the system could capture much of the leaking oiling, but acknowledges that the relief wells remain the primary solution.

ORR scientists continue produce daily trajectories of the surface oil. For the nearshore region, moderate southerly winds are forecast to resume and continue through Monday at 5-10 kts. These winds may begin moving oil that has been tending to the southwest from the source towards the Delta. In addition to continued threats to shorelines in Breton and Chandeleur Sounds, model results indicate that some oil may move north to threaten the barrier islands off Mississippi and Alabama later in the forecast period. ORR continues to track the light tendril of oil near the northern end of the loop current. Overflights to this region have observed streamers of emulsified oil no further south than approximately 28 degrees N, with contiguous, colorless sheens continuing in a narrow band as seen in the satellite imagery. Trajectories for remaining observed oil within this region suggest some of these scattered sheens will continue to be entrained into a counter-clockwise eddy, while some may move into the Loop Current Eddy and persist as very widely scattered tarballs not visible from imagery.

The Regional Response Team (RRT) is exploring alternative response methods for protecting and cleaning up marshes. The Department of Agriculture’s National Resource Conservation Service continues to push forward a plan to deploy organic sorbents to help protect marshes from oil. The material would be placed on the marshes before oiling. There is little to no evidence that this technique will succeed and the potential impacts from the release of oil organic material from the marsh has not been adequately addressed. The method has the potential to generate large amounts of oily debris. ORR suggested a small pilot study to determine if the approach could be effective in protecting marshes and how the organic sorbents behave when oiled.

The presence of “submerged oil plumes” off the coast of Florida and Alabama remains a top news story. There is still no analytic confirmation of the nature and concentration of oil in these plumes. The R/V Pelican first reported these plumes last week. A NOAA contracted lab at Louisiana State University bas analyzed the first set of samples from the Pelican cruise and

found no evidence of oil. Additional samples are being run. Several issues with sample handling limit interpretation of these results. Samples of the plume area from the R/V Weatherbird II have arrived at Alpha lab and are priority for analysis. The Weatherbird was met with a “media frenzy” when they arrived at the dock, and it is still unclear whether the scientists were misquoted when they reported finding huge additional plumes this week.

Management of the various cruises continues to be a major scientific coordination activity. A Deepwater Monitoring group has been established to improve coordination and data flow between the vessels on scene and the Unified Command.

[redacted]

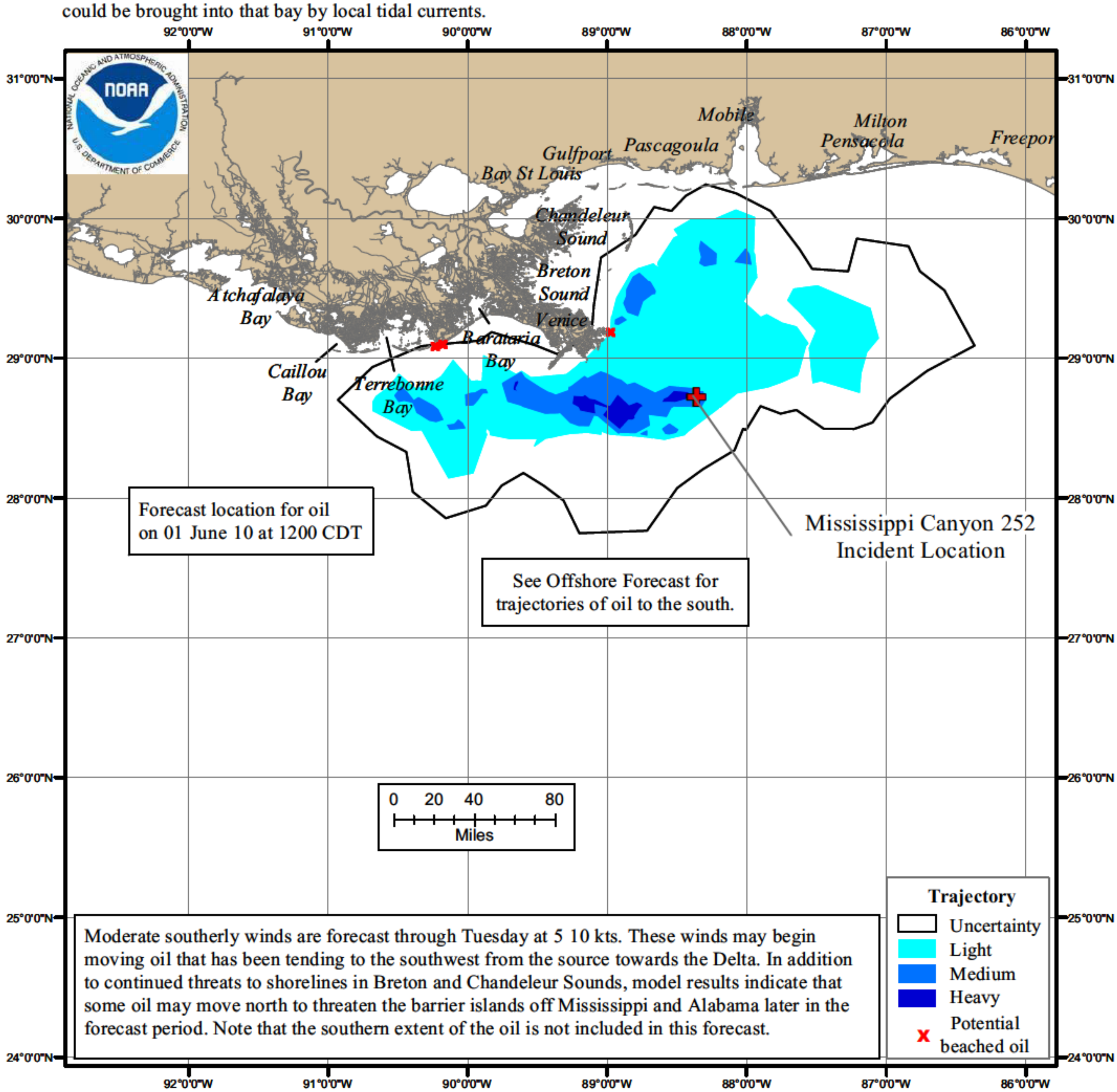
Nearshore Surface Oil Forecast Deepwater Horizon MC252

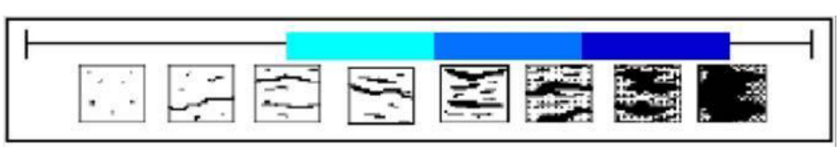
NOAA/NOS/OR&R

Nearshore

Estimate for: 1200 CDT, Tuesday, 6/01/10
Date Prepared: 2100 CDT, Saturday, 5/29/10

This forecast is based on the NWS spot forecast from Saturday, May 29 PM. Currents were obtained from several models (NOAA Gulf of Mexico, West Florida Shelf/USF, NAVO/NRL) and HFR measurements. The model was initialized from Friday and Saturday satellite imagery analysis (NOAA/NESDIS) and overflight observations. The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization). Oil near bay inlets could be brought into that bay by local tidal currents.





this scale bar shows the meaning of the distribution terms at the current time

Next Forecast:
May 30th PM

Received(Date): Sun, 30 May 2010 10:30:04 -0400
From: David Holst <David.Holst@noaa.gov>
Subject: [Fwd: Prep for NRT Meeting, May 30, 2010]
To: _NOAA HQ leadership <NOAAHQ.Leadership@noaa.gov>, Policy.Contacts@noaa.gov,PCO.Contacts@noaa.gov, "Deepwater NOAA Support (dwh.staff@noaa.gov)"<dwh.staff@noaa.gov>, David Kennedy <David.Kennedy@noaa.gov>,"Sarri, Kristen" <KSarri@doc.gov>,Timothy Gallagher <timothy.gallagher@noaa.gov>
NRT Agenda 30 May 1100 mtg.doc

-------- Original Message --------

Subject: Prep for NRT Meeting, May 30, 2010
Date: Sun, 30 May 2010 10:24:06 -0400
From:william.conner <William.Conner@noaa.gov>
To: HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>
CC: Ken Barton <Ken.Barton@noaa.gov>

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May 30, 2010
National Response Team Meeting at 1100:

Call in Number: 1-[redacted] and participation pin is:[redacted]
Please dial in 15 minutes before the call for a roll call starting at 10-minutes before the scheduled start time.

NOAA SSC Charlie Henry will be with RADM Landry at the Unified Area Command in Robert, LA. Any detailed or technical questions may be referred to him.

DOC/NOAA Objectives for the Meeting:

1. Convey substantive messages about NOAA involvement in the response.
2. Acquire current status of response, coordination and outreach efforts.
3. Answer questions on NOAA activities and products.

The agenda for the NRT meeting is attached. There are no agenda items assigned to NOAA and the agency does not have a priority message to convey at today's meeting.

The following NOAA products have been distributed to the NRT agencies prior to the meeting:

- Most recent Spot Weather Forecast
- Coastal trajectory prediction for location of surface oil with 72-hour outlook
- Offshore trajectory prediction for location of surface oil with 72-hour outlook
- Shoreline Impact Outlook showing likely new landfalls of oil over the coming 5 days

Overview of NOAA products

- Weather
    - Light winds will continue from the S and SW through Tuesday. Seas will be calm with a light chop. Isolated thunderstorms may disrupt spill operations late in the day.
- Coastal Trajectory
    - Southerly winds will tend to push the oil back onshore with fresh deposits possible on the east or west sides of the Delta. Note that heavy parts of the slick are proximate to the tip of the Delta and west side. By mid-week, it is possible that oil could spread to the east, possibly involving the Mobile Bay area and even Pensacola (see Coastal Impact Outlook).

- Loop Current with Offshore Trajectory (not updated today)

    - The northern part of the LC remains separated, and has formed a large clockwise eddy over 100 miles south of the spill site. As a result, any small amounts of oil that may reach this eddy will be moved in a large circular pattern in the middle of the Gulf, and not threaten any shorelines. There is also minimal risk of the LC serving as a significant mechanism to transport oil toward any shorelines and there is no evidence to suggest significant amounts of oil are moving toward the LC. The eddy discussed above will likely re-attach to the Loop Current over the next week or two. Only non-contiguous sheens and scattered tarballs are visible in this eddy.

Agenda Item: Polling of NRT Secretaries

No priority messages have been identified for NOAA to contribute.

William G. Conner, Ph.D.
Chief, HAZMAT Emergency Response Division
NOAA Office of Response and Restoration
Phone: [redacted] (190)
Cell: [redacted]

BP Oil Spill Response – Gulf of Mexico Incident
National Response Team (NRT) Phone Conference Meeting

AGENDA

Conference call-in phone number: 1-[redacted] and participation pin is:[redacted]
May 30, 2010 11:00 AM EDT

Objective: Secretary Napolitano and the National Incident Commander (NIC) have requested a conference call with NRT Agency Heads (Secretary Level) today at 11:00 AM EDT. This meeting should last no longer than 30 minutes.

Audience: NRT Agency Heads (Secretary Level) plus one member. Regional Response Team IV and VI Co-Chairs may call in.

May 30, 2010

Call In	
Roll Call	USCG
Significant Activities	NIC
SubSurface Response Status	
On Water Recovery Status	
Shoreline Response Status	
Weather/Oil Trajectories	
Polling of NRT Secretaries	USCG
Communication Update	OPA
Legal Affairs Update	OGC
Intergovernmental Affairs Update	IGA
Congressional Affairs Update	OLA
Secretary's Closing Remarks	S-1
Meeting Adjourned	

UNCLASSIFIED

Received(Date): Sun, 30 May 2010 14:35:44 -0400
From: "Jainey.Bavishi" <Jainey.Bavishi@noaa.gov>
Subject: [Fwd: Seafood safety fact sheet]
To: "'Andrew.Winer@noaa.gov'" <Andrew.Winer@noaa.gov>,John Rapp <John.Rapp@noaa.gov>
Seafood safety fact sheet.eml

Andy,

This is the latest version of the seafood safety fact sheet I have. To my knowledge, it has not been cleared. John will be "on call" tomorrow and can provide more information on its status.

Jainey

Received(Date): Wed, 26 May 2010 13:03:31 -0400
From: John Rapp <John.Rapp@noaa.gov>
Subject: Seafood safety fact sheet
To: "Gilson, Shannon" <SGilson@doc.gov>
Cc: Scott Smullen <Scott.Smullen@noaa.gov>,Jennifer Austin <Jennifer.Austin@noaa.gov>,_HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>,Lauren B Lugo <Lauren.B.Lugo@noaa.gov>, Brian Pawlak <Brian.T.Pawlak@noaa.gov>
2010_0521_seafood safety two pager_with FDA letter.docx

Shannon,

NOAA prepared the attached fact sheet on seafood safety. Can you let me know if DOC clears it and, if so, whether you or I should push it forward for clearance at OMB?

Thanks,
John

Seafood Safety Response to the Deepwater Horizon Oil Spill

NOAA
FISHERIES
SERVICE

Federal Agency Roles in Seafood Safety

Under the Federal Food, Drug, and Cosmetic Act, the U.S. Food and Drug Administration (FDA) is the regulatory authority for seafood safety in the United States. Under a variety of statutory authorities, NOAA manages federal fisheries; provides seafood quality certification and inspection services; and conducts research, testing and analysis on seafood contaminants and health.

Impacts of Crude Oil on Seafood

Crude oil has the potential to taint seafood with flavors and odors imparted by exposure to oil-derived contaminants. Crude oil and dispersants could also contaminate seafood with chemical compounds that may be unsafe for human consumption. FDA regulations consider the presence of oil-derived contaminants and dispersant chemicals in seafood as possible "adulterants" (an unwanted chemical substance). Seafood that is adulterated may not be sold.

Fishery Closures

Beginning on May 2, 2010, NOAA acted swifty and strategically, using the best available scientific information to establish precautionary fishery closures in federal waters to ensure public safety and assure consumer confidence in Gulf of Mexico seafood. Fisheries closures are the most immediate way to prevent harvesting of seafood from areas potentially affected by oil. The current closures (http://sero.nmfs.noaa.gov/deepwater_horizon_oil_spill.htm) encompass the area known to be affected by oil as well as areas projected to be affected by oil. NOAA reviews oil observations and trajectories daily, and modifies the boundaries of the closed area as new information becomes available.

On May 18, 2010, FDA sent a letter to NOAA stating that it agrees that NOAA's closures in federal waters are an appropriate public health measure to prevent potentially unsafe seafood from being harvested and reaching consumers.

Offshore Surveillance and Monitoring

Routine evaluation and, if needed, expansion of the fishing closure form just one part of the federal response to ensure seafood safety. NOAA Fisheries Service is also collecting and evaluating seafood samples to assess the extent of any potential contamination both within the immediate spill area and throughout the Gulf.

1315 East West Highway
Silver Spring, MD 20910
Phone: 301 713 2355
Fax: 301 713 1081
Toll free: 800 422 2750
NMFS.Seafood.Services@noaa.gov
www.seafood.nmfs.noaa.gov

NOAA is collecting a variety of types of seafood including finfish, shrimp, crabs, and shellfish. The samples will be evaluated before a closed area affected by oil is re-opened to fishing. The samples are sent to laboratories for sensory (smell and taste) and chemical analysis to determine whether contamination is present and to what level.

Re-Opening Protocol

Before areas directly affected by oil can be re-opened to harvesting, seafood samples collected from the area must meet rigorous sensory and chemical analysis criteria. NOAA and FDA have agreed to a uniform re-opening protocol that applies to all species of fish and shellfish. Under the protocol, an area may be re-opened to harvesting for some species before it is open to all species. A closed area directly affected by oil will not be re-opened until sensory and chemical analysis demonstrates that contaminant levels are below levels necessary to protect public health. NOAA and FDA have provided the protocol to the states for use when making decisions about re-opening state waters closed to harvesting.

Federal and State Partnership

NOAA and FDA are working with other federal and state partners to protect consumers from contaminated seafood, while minimizing undue economic burdens on the recreational and commercial fishing, and seafood industries. NOAA has requested that each Gulf state governor provide a single high level state official to be the primary contact for sharing and disseminating information about seafood safety. NOAA is communicating on a regular basis with these state officials.

Fee-for-Service Inspections

NOAA's Seafood Inspection Program is available to inspect seafood to ensure it meets all food regulatory and export requirements. The program can certify that seafood is not tainted with oil-derived contaminants. Inspection services are available to industry for a fee. To learn more visit: www.seafood.nmfs.noaa.gov

For more information, please contact:
  Media Inquiries: NOAA Public Affairs
  Technical Questions: NOAA Fisheries Service
  Inspection Services: NOAA Seafood Inspection Program

Last Updated: May 26, 2010

Received(Date): Mon, 31 May 2010 11:57:32 -0400
From: John Oliver <John.Oliver@noaa.gov>
Subject: Modification to closed area for May 31
To: Jane.Lubchenco@noaa.gov, Margaret.Spring@noaa.gov, Monica.Medina@noaa.gov,Mary.Glackin@noaa.gov, Lois.Schiffer@noaa.gov, Justin.kenney@noaa.gov,David.Kennedy@noaa.gov, Sally.Yozell@noaa.gov, Dave.Westerholm@noaa.gov,Nancy.Wallace@noaa.gov, John.Rapp@noaa.gov, Kelly.Denit@noaa.gov,Christopher.Meaney@noaa.gov, Ryan.Wulff@noaa.gov,Jessica Kondel <Jessica.Kondel@noaa.gov>,Brian Pawlak <Brian.T.Pawlak@noaa.gov>, Samuel.Rauch@noaa.gov,Steve Murawski <Steve.Murawski@noaa.gov>, John Oliver <John.Oliver@noaa.gov>,Gloria Thompson <Gloria.Thompson@noaa.gov>, Roy.Crabtree@noaa.gov,Rebecca.Chiampi@noaa.gov, Buck.Sutter@noaa.gov, Heather.Blough@noaa.gov,Phil.Steele@noaa.gov, Emily.Lindow@noaa.gov, Nancy.Thompson@noaa.gov,Bonnie Ponwith <Bonnie.Ponwith@noaa.gov>, Charles.Green@noaa.gov,Brian.K.Taggart@noaa.gov, Adam.Issenberg@noaa.gov, Alan.Risenhoover@noaa.gov,Emily Menashes <Emily.Menashes@noaa.gov>,Eric Schwaab <Eric.Schwaab@noaa.gov>, Steven.Gallagher@noaa.gov,Michael S Gallagher <Michael.S.Gallagher@noaa.gov>, Deb.Lambert@noaa.gov,Lauren.B.Lugo@noaa.gov, John.Gray@noaa.gov, Jane.Chalmers@noaa.gov,Amanda.Hallberg@noaa.gov, Scott.Smullen@noaa.gov, Jennifer.Austin@noaa.gov,Hal.Robbins@noaa.gov, Tracy.Dunn@noaa.gov, Christopher.S.Moore@noaa.gov,ICC.HSPO@noaa.gov, Amrit.Mehra@noaa.gov, Jcostanza@doc.gov, Ksarri@doc.gov,Larry.Robinson1@noaa.gov, Laurel Bryant <Laurel.Bryant@noaa.gov>,Monica.Allen@noaa.gov, kim.amendola@noaa.gov, Gary.Reisner@noaa.gov,_HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>, ICC.NMFS@noaa.gov,Beth Dieveney <Beth.Dieveney@noaa.gov>

Happy Memorial Day, all -

We are extending the northern boundary of the closure to encompass a portion of the slick moving toward the state-federal water line off eastern Mississippi/western Alabama. The new closure map is attached. PLEASE DO NOT DISTRIBUTE UNTIL POSTED ONLINE. We intend to post the map (and supporting materials) at or before noon today. The new closure would become effective at 6 PM Eastern Time tonight.

The new closure measures 61,854 sq mi (160,200 sq km), or about 26% of the GOM EEZ, compared to the May 28 closure comprising 60,683 sq mi (157,169 sq km), or about 25% of the GOM EEZ. jo

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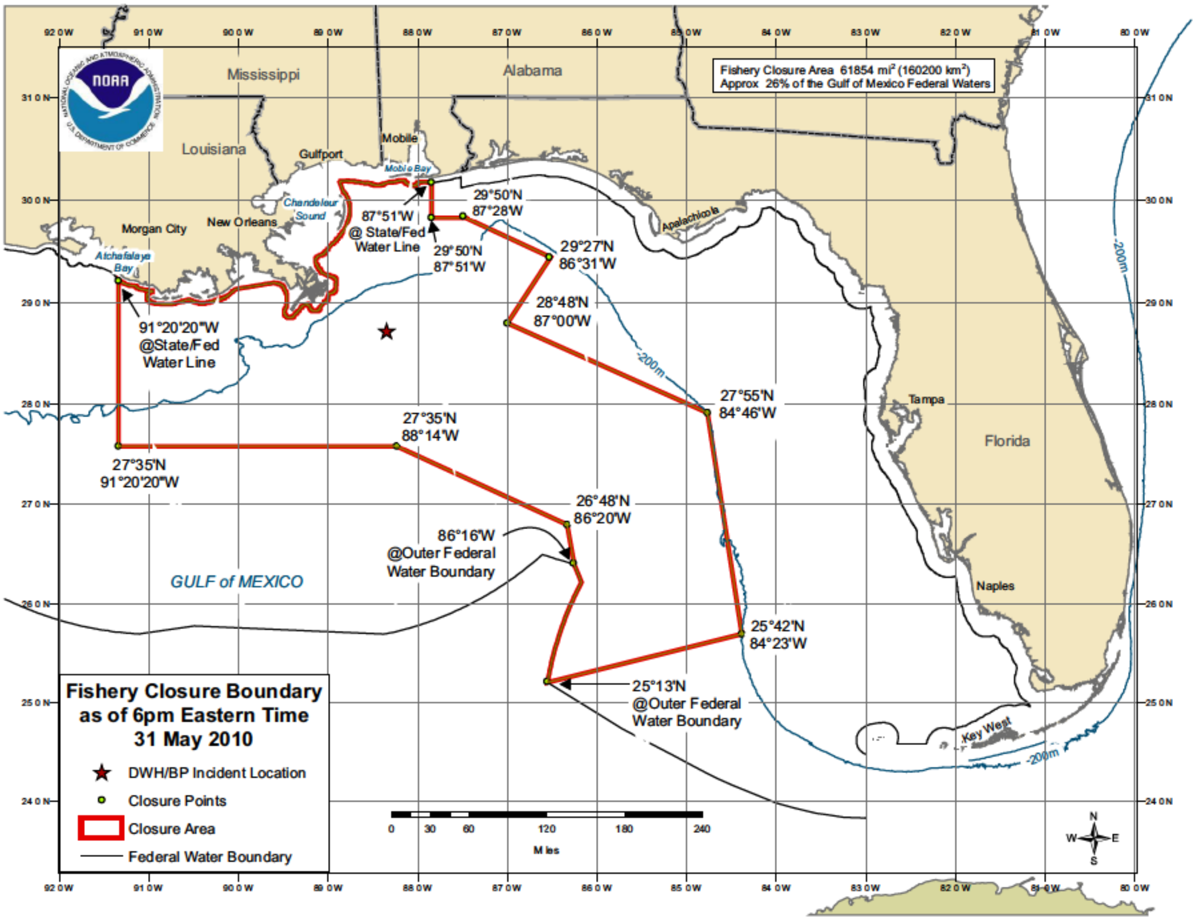
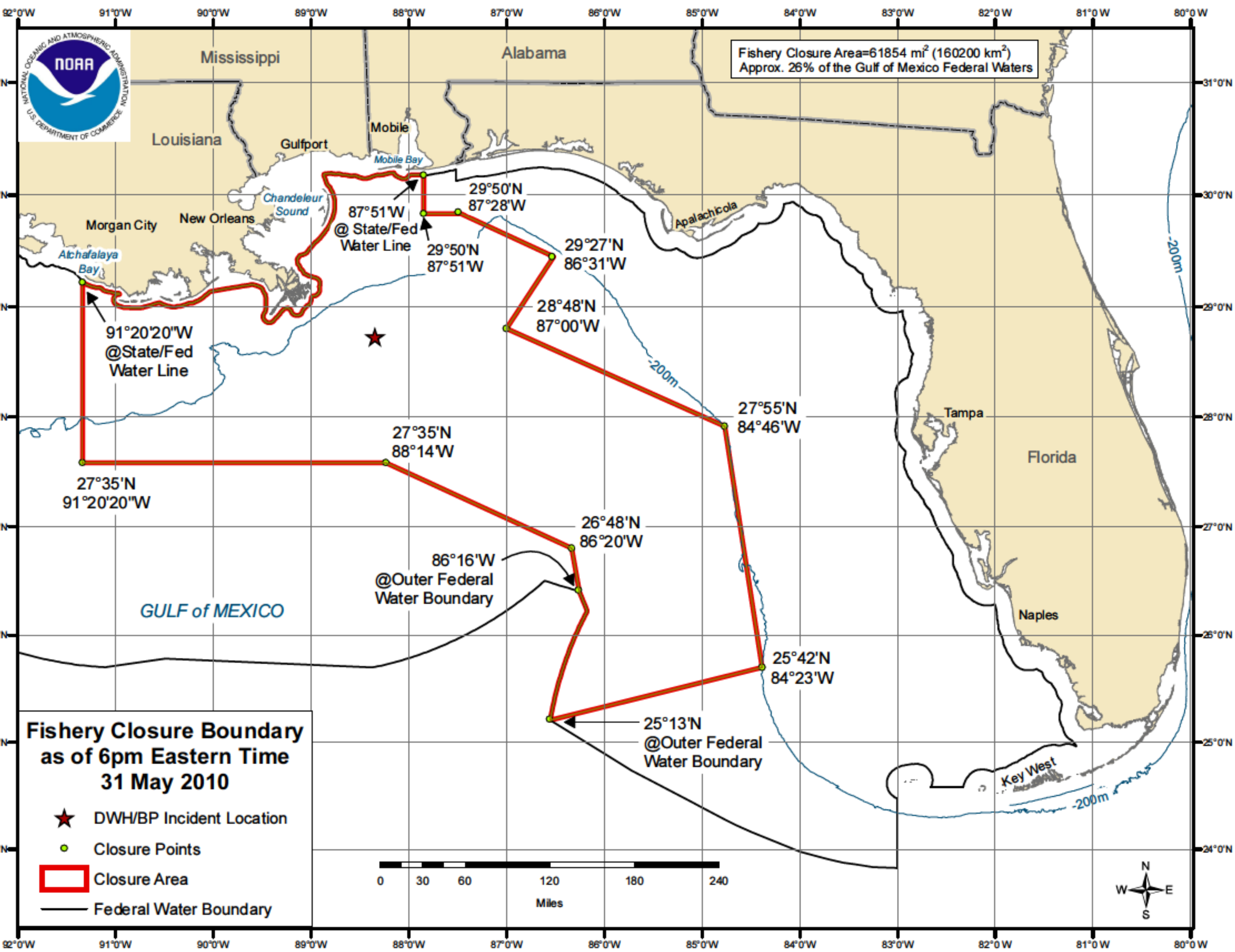

Fishery Closure Area 61854 mi² (160200 km²)
Approx 26% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Louisiana
Florida
Gulfport
Mobile
Mobile Bay
Chandeleur Sound
New Orleans
Morgan City
Atchafalaya Bay
Apalachicola
Tampa
Naples
Key West
GULF of MEXICO
29°50'N 87°28'W
87°51'W @ State/Fed Water Line
29°50'N 87°51'W
29°27'N 86°31'W
28°48'N 87°00'W
91°20'20"W @State/Fed Water Line
27°55'N 84°46'W
27°35'N 88°14'W
27°35'N 91°20'20"W
26°48'N 86°20'W
86°16'W @Outer Federal Water Boundary
25°42'N 84°23'W
25°13'N @Outer Federal Water Boundary
-200m
Fishery Closure Boundary as of 6pm Eastern Time 31 May 2010
DWH/BP Incident Location
Closure Points
Closure Area
Federal Water Boundary
Miles



Document ID: 0.7.19.1744.1

Received(Date): Mon, 31 May 2010 14:18:19 -0400
From: Linda.Belton@noaa.gov
Subject: Agenda for Governor's Call Tuesday, June1
To: dwh.staff@noaa.gov, Monica.Medina@noaa.gov, David.Kennedy@noaa.gov,Dave.Westerholm@noaa.gov, John.Gray@noaa.gov, Sally.Yozell@noaa.gov
Cc: Jen.Pizza@noaa.gov, Adele.Stevens@noaa.gov, Jacqueline.J.Rousseau@noaa.gov

All,

Draft agenda for the pre-call tomorrow is below. Please let me know if there are any changes.

Tuesday, June 1 Call with Governors

9:05 a.m. pre-brief; 9:15 Governors

1-[redacted]

HOST Pin:[redacted]**– Speakers**

Please let me know if there are any changes to the speakers below. Also, please be prepared to cover the action items that came up on yesterday's call.

<u>DRAFT AGENDA</u>

Call with Governors – 9:05 a.m. pre-brief; 9:15 Governor

Opening remarks **(Valerie Jarrett)**

· Observations and Trajectory – **David Kennedy, NOAA**

o NOAA will provide the latest observations and trajectories

o NOAA—fishery closure today due to change in wind

· Situation &Leak Stabilization Update –**RADM Peter Neffenger, NIC**

· Peter—BP will be submitting its new dispersants management plan given the top hat/cap procedure. We expect it today

· Jindal—asked about the flow, and whether it is unimpeded now (i.e., now riser insertion tube). Yes

· Jindal—asked when they will commence the cut. (possibly by later this evening)

· Allen reported on the Tuesday Barrier/Berm meeting. It will take place in New Orleans from 1-4:30. We need to get the following information out to all of the states:

o Logistics – where, when, contact (Scott Lundgren)

o Agenda

o Attendees (who we want there)

Adm. Allen said we are moving forward on the remaining 5 projects (permitted not funded). Laid out the issues: 1) feasibility; 2) is it bonefied spill response; 3) part of Corps plan; and applicability to other berm projects. Gov. Jindal asked when final decision. Allen said we will forward recommendation out of meeting to POTUS for his consideration. We need to do our due diligence for President, but expects a good outcome. Gov. Jindal pressed that this is his top prioritiy. He hopes feds will be forthcoming on information that the state has not yet received, i.e., why the 1 project (most difficult) was permitted and funded, and the other 5 were not funded. It has created confusion for the state. Adm. Allen said we will have total visibility on the issues. Gov. Jindal said any time the Corps has asked for information, the state has provided it, but they have never heard back whether there were any concerns about the information provided. Gov. Riley's homeland security director asked who from AL do we want at the meeting. Allen said a technical rep with expertise on berms and barrier islands.

· Operations Report –**RADM Admiral Watson, UAC**

o Response Plans and Boom

· Update on the Flow Rate Task Force – Marcia McNutt, USGS

o Jindal asked if we have any estimate on the amount of oil that remains on top of water. Adm Watson said we need to develop methodology for that question, but that we could probably get an answer

· Open discussion and Q&A with Governors and state officials

· Next call – 9:15 a.m. EDT (8:15 CDT) Wednesday, June 2, 2010

All,

Draft agenda for the pre-call tomorrow is below. Please let me know if there are any changes.

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9:05 a.m. pre-brief; 9:15 Governors

1-[redacted]

HOST Pin: [redacted]

Please let me know if there are any changes to the speakers below. Also, please be prepared to cover the action items that came up on yesterdays call.

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Next call 9:15 a.m. EDT (8:15 CDT) Wednesday, June 2, 2010

Received(Date): Mon, 31 May 2010 16:59:44 -0400
From: John Rapp <John.Rapp@noaa.gov>
Subject: May 31 NOAA Deepwater Horizon End of Day Update
To: DWH leadership <DWH.Leadership@noaa.gov>
DWH_BP_OilSpill_FisheryClosureMap_0528_3110.pdf
Mammal_and_Turtle_Stranding_Report_30_May data_FINAL.doc
Proposed OMAO Asset DWH Response Schedule 053110.doc
OMAO_Assets_Gantt_Chart_053110.xlsx
DWH_ACTIONS_and_UPDATES_5.31.2010.xlsx

Significant updates for May 31 are below and attached in the Excel spreadsheet. Additional documents are also attached.

ISSUE TEAMS:

Response Operations (Bill Conner)

ICC

- Stood up an integrated analysis team to examine the Brooks McCall (near-field) data to-date. Initial report due 2 June. NOAA, EPA, and BP all represented.
- A longer-term synthesis team is also being established to analyze data integrated from multiple vessels, AUVs and air-dropped sondes. The outcomes will help inform the Area Command and the modeling teams.
- Began drafting a "strawman" overall sampling needs document to document the response phase needs. This can then be vetted by others to enable better mission planning.
- Established feedback loop call series with NOAA modeling teams and sampling leads.
- Multi-party (NOAA, BP, EPA) discussion about longer-term sampling needs (will be picked up by NOAA Research Council and others).
- Continued coordination between NOAA, EPA, and BP on integrated mission planning.
- Continued development of ERMA data layers to reflect growing sub-surface sampling activities.
- Stood of a formal Subsurface Monitoring Branch, within the Environmental Unit, with base of operations in Houma.
- 3 additional vessels now transmitting daily reports and/or data (Walton Smith, Gordon Gunter, Ocean Veritas)
- 6 IOOS community gliders on active missions and transmitting data (http://rucool.marine.rutgers.edu/deepwater).
- Initial development of three new graphics (all will be ready for distro in next 24-48 hours):
  - Overall conceptual graphic to convey the range of sub-surface observations
  - Theater-wide informational map of operating zones for vessels, gliders, and air-dropped sondes (weekly)
  - Operations graphic showing active grid zones based on USAF grid that is used for all other operations (air, marine, etc.)

NRT

- Cutting the riser pipe above the BOP will not start before tomorrow. After completing the cut, dispersants will be injected to mitigate the increased flow of oil while work continues on the Cap.

- Tar mats are being recovered today 30 miles off Mobile Bay as well as tar paddies 13 miles off Dauphin Island. These occurrences of oil are consistent with the NOAA surface oil trajectory for coastal areas.
- RADM Landry will rotate out of the response to be replaced by RADM Watson.

NIC Activities

- By 0800 tomorrow NOAA IASG tasked to provide update on status of efforts to establish location, trajectory and content of any subsurface plumes. Juliette Kayyem will need this info for tomorrow's Governors' call. Input solicited from the Science group and UAC as well as the modelers in Seattle working on the 3D sub surface issue. In addition detailing proposed charter for the NIC requested Subsurface Oil Technical team to be lead by NOAA.
- NOAA provided an updated version of the Marsh Response Options fact sheet that included incident specific text and pictures. Incorporates comments from USDA, DOI & UAC. Must be reviewed again by the IASG prior to distribution as a joint document.
- NOAA reviewing all the Cuba related documents to determine if changes must be made as a result of the latest trajectory uncertainty being within 100 miles of Cuba. Cuba briefing scheduled for 1500 tomorrow (Tuesday) at DoS.

Science (Steve Murawski)

- NOAA FSV GORDON GUNTER continues to sample in the vicinity of the wellhead using simrad EK-60, ADCP, water-on-a-wire, GULPER AUV, Sipper video plankton recorder and MOCNESS for biological community as well as full suite of CTD including flurometer. There objective is to separate biological phemonena and naturally occurring vs. MC 252 hydrocarbons. Working in concert with Walton Smith and Pelican
- NOAA R/V THOMAS JEFFERSON in port at New Orleanbs embarking acoustics and water sampling science parties to udertake hunt for sub-surface oil from SW Pass west
- Chartered vessels SIMPLE MAN, HST, BEAU RIVAGE collecting samples for seafood safety analysis
- NOAA Vessels CARETTA and GABDT taking seafood baseline samples
- several academic vessels also in vicinity including PELICAN and WALTON SMITH
- Contract Vessels BROOKS McCall, OCEAN VERITAS and FRITZ also sampling near well head for oil/dispersants and toxicity

Living Marine Resources (John Oliver)

Fisheries Closure

- The northern boundary of the closed area has been extended to encompass a portion of the slick moving toward the state-federal water line off eastern Mississippi/western Alabama.
- The new area goes into effect at 6pm EST, May 31, 2010.
- The new closure measures 61,854 sq mi (160,200 sq km), or about 26% of the GOM EEZ, compared to the May 28 closure comprising 60,683 sq mi (157,169 sq km), or about 25% of the GOM EEZ.

The Gulf Regional Team science lead is working with the Science issue box to address the following data processing
needs:

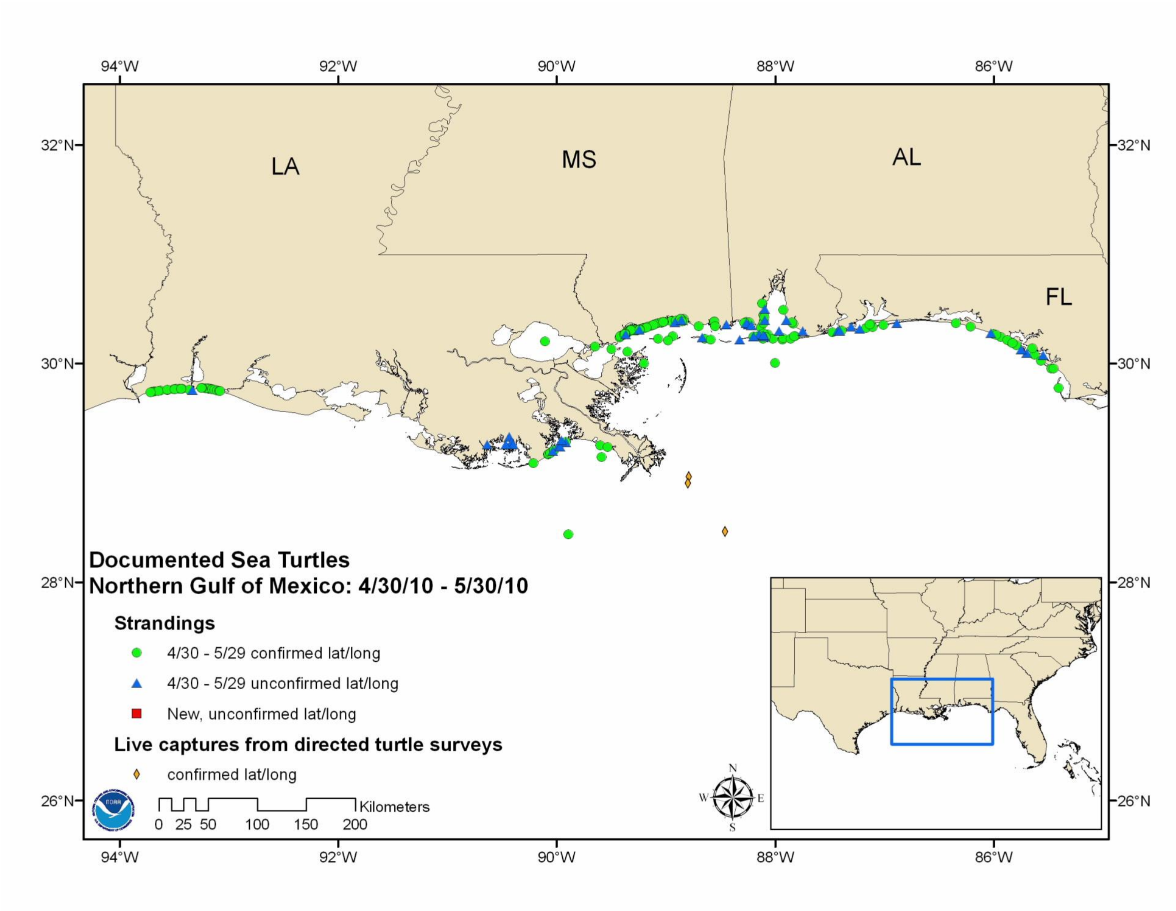
- CTD data processing: bin average and de-spike all casts, make results available as ascii files
- Profile plots of all ctd data, with bottle sample results on same plot at correct depths
- map view contour plots of all ctd data at standard WODB depths, by cruise as well as cumulative.
- map view contour plots of bottle data at standard bottle depths (3 or 11 depths depending on cruise) [DO, Fluorescence, and the hydrocarbon analysis]
- cross section and contour plots of historical data [Fluorescence too if in WOD]
- representative profile plots of ctd variables (including fluorometry)
    - anomaly product with particular emphasis on Fluorescence and DO [mean - ob with WOA variance]
- translation of all data to netcdf using common variable names; make available via TDS)

Comms./Public Affairs (Justin Kenney):

- Dr. Samuel Walker (NOAA IOOS) and LCDR Demian Bailey (NOAA Corps) took part in a press event regarding the NOAA Ship Gordon Gunter mission. CNN and AP covered the cruise

Data and Information Management (Joe Klimavicz):

- Data on geoplatform.gov is updating as expected, and site performance is sufficient to allow Unified Command full and open access tomorrow.
- Received confirmation on tomorrow's deliveries of additional servers for geoplatform.gov and our data centers are ready for deployment.



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LA
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Documented Sea Turtles
Northern Gulf of Mexico: 4/30/10 - 5/30/10
Strandings
4/30 - 5/29 confirmed lat/long
4/30 - 5/29 unconfirmed lat/long
New, unconfirmed lat/long
Live captures from directed turtle surveys
confirmed lat/long
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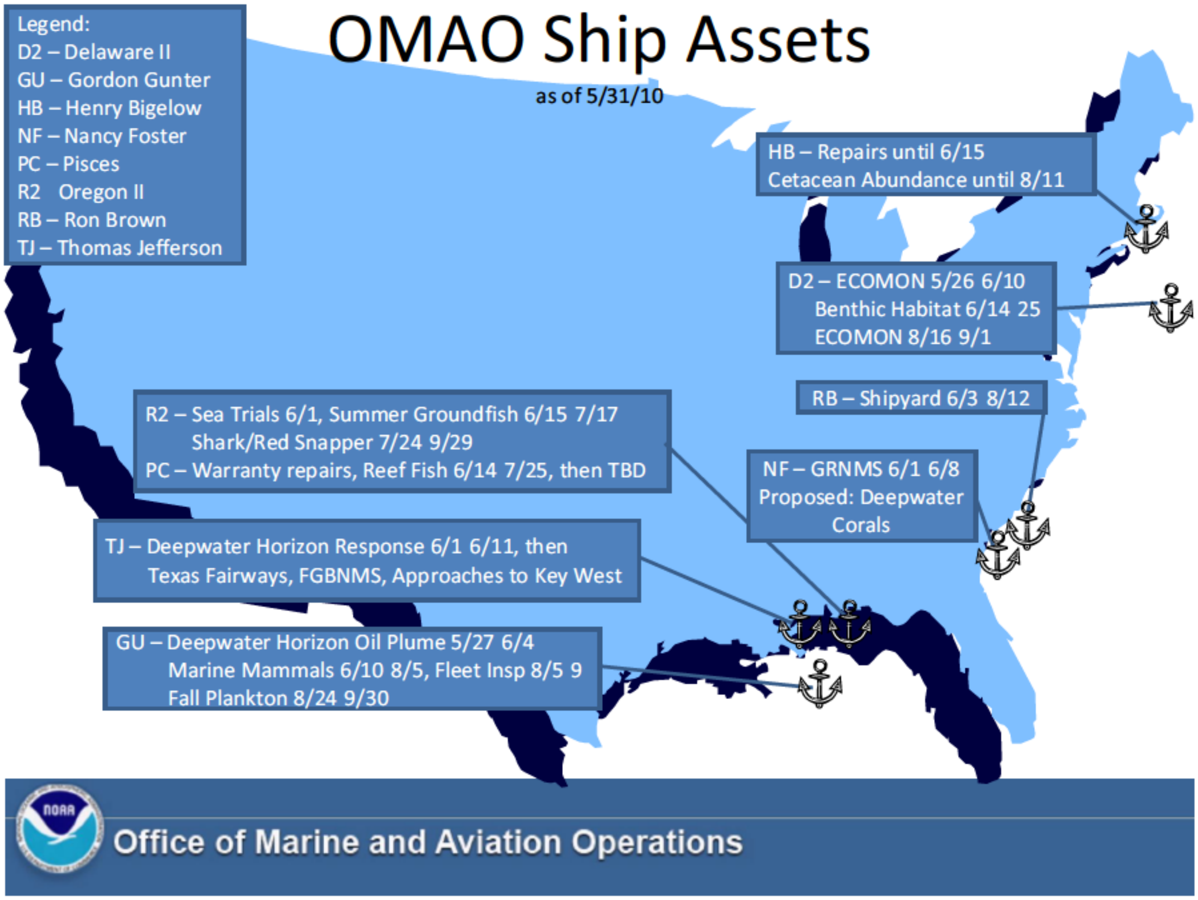


Document ID: 0.7.19.1829

Received(Date): Tue, 01 Jun 2010 09:32:57 -0400
From: "Christopher.S.Moore" <Christopher.S.Moore@noaa.gov>
Subject: May 31 ICC Sitrep
To: Deepwater.HorizonDist@noaa.gov
may 31 slb.pdf

FOR OFFICIAL USE ONLY / NOT FOR PUBLIC RELEASE

CAPT Christopher S. Moore, NOAA

Director, NOAA Homeland Security Program Office

Office: [redacted]

Fax: [redacted]

Cell: [redacted]

E mail: *christopher.s.moore@noaa.gov*

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through COB 31 May 2010

Fisheries Closure

- The northern boundary of the fisheries closure area was extended last night and now covers about 26% of the GOM EEZ.

NOAA Ship Gordon Gunter
- Working daytime and nighttime acoustic transects and water sampling within a 5 nm perimeter of well head.
- Water consumption rate is on track for scheduled endurance until 04 June.

NOAA Ship Thomas Jefferson
- Alongside New Orleans staging for DWH "Western Sentry" Project.
- Departure delayed until Wednesday, June 2 to spool on CTD wire and install the Moving Vessel Profiler (MVP) on Tuesday.

R/V Beau Rivage
- West of the Mississippi River in LA waters and working East. They are trawling in non-oiled areas to collect baseline samples for the National Seafood Inspection Laboratory. ETA Pascagoula is Friday.

R/V Jack Fitz (a CSA International vessel)
- Yesterday was conducting ROV operations 2 1/2 km to NNE of discharge point
- Today Alongside in Port Fouchon
- Visually observed oil droplets in water column at 3300 ft at location 2km SSW of well head. Mounted collection grid on ROV to sample accumulation of oil droplets.

R/V Walton Smith (UNOLS/RSMAS)
- Deep water sampling and deploying underwater camera.
- Tracking subsurface oil plume feature they are describing as extending 8-9 nm WSW of the well head at a depth of 1100-1300m.

R/V Brooks McCall (Carrying an NCCOS scientist)
- 3-4 CTDs/day to define the outer edge of plume boundaries.

R/V Ocean Veritas (BP Contract vessel)
- In port following a CTD malfunction

R/V Pelican
- No Report

Gliders
- 6 IOOS community gliders on active missions and transmitting data

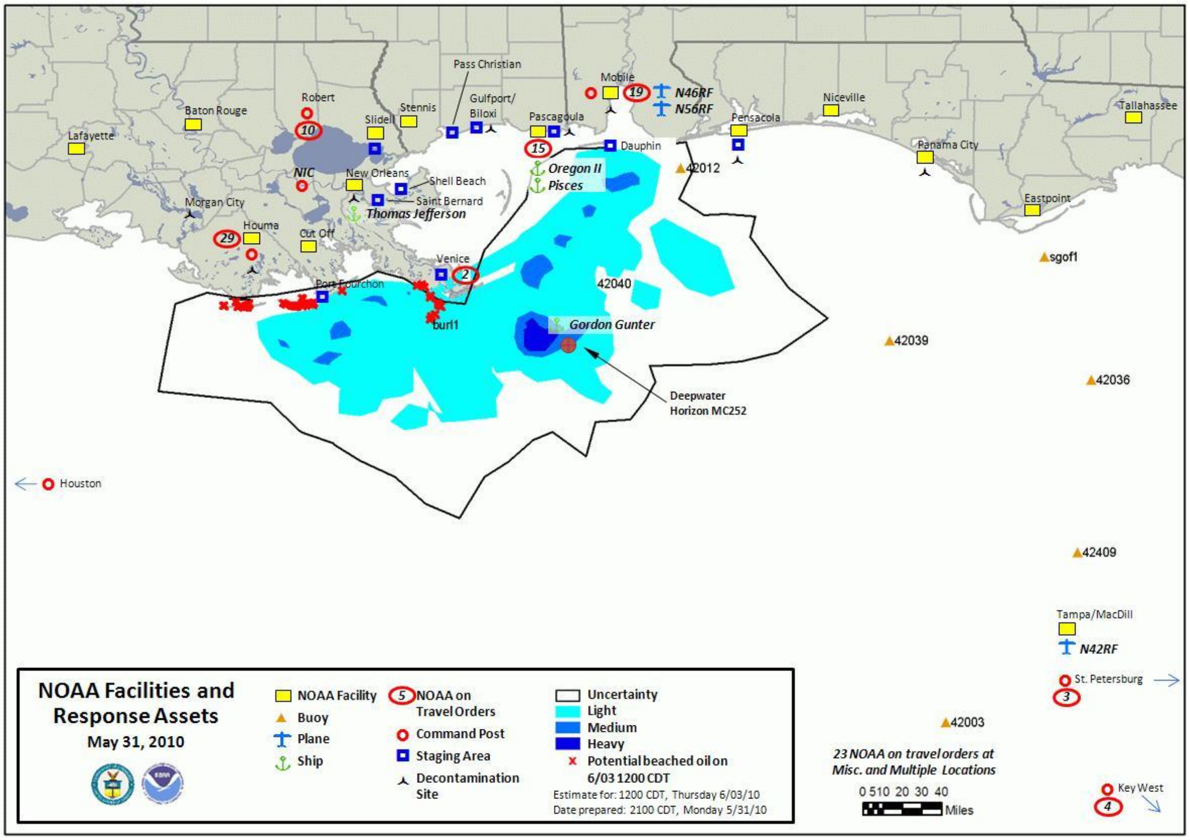
Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through COB 31 May 2010

Aircraft Operations Summary

- Total flight time flown for 30 May 2010: 0.0 Hours
- Total flight time flown for 31 May 2010: 3.9 Hours
- Total flight time scheduled for 01 June : 6.5 Hours for Coastal Mapping & Photography
- Total DWH/PEE flight time to date: 303.4 hrs
- Twin Otter N46 is down today for unscheduled maintenance

	Command, Information Centers and Staging Areas	**Total NOAA Staff:**
Area Command Post	ROBERT, LA	**10**
Unified Incident Cmd	HOUMA, LA	**29**
Unified Incident Cmd	MOBILE, AL	**19**
Unified Incident Cmd	ST. PETERSBURG, FL	**3**
Unified Incident Cmd	KEY WEST, FL	**4**
Unified Incident Cmd - Source Control	HOUSTON, TX	**0**
Staging Areas		
Venice, LA	Venice, LA	**2**
Pascagoula, MS	Pascagoula, MS	**15**
	TOTAL DEPLOYED NOAA STAFF:	***82***
	Miscellaneous/Various Locations:	23
	Total Deployed NOAA Staff:	***105***

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through COB 31 May 2010



Received(Date): Wed, 02 Jun 2010 12:00:14 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: Gulf of Mexico update for June 1
Technical Update Post Top Kill v2.ZIP

Herein you will find two items:

1) Update for June 1st

2) Technical Update Slides

Gulf of Mexico Oil Spill Response Update

06/01/2010 – 10:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the sea floor to stop the flow of oil through various strategies;
2. On the surface to minimize impacts of the spill; and
3. Onshore to protect the shoreline and inform the public.

Highlights

- Lower Marine Riser Package Cap procedure is underway.
- Additional containment options under development.
- $40 million in claims paid -- 500 claims adjustors working across the Gulf Coast.
- Subsea dispersant use continues.

- Both relief wells are progressing.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

ContainmentRecovery Systems - Note: see attached PDF which contains slides highlighting the following options

Lower Marine Riser Package (LMRP) Cap containment option now being actively deployed involves removing the damaged riser from the top of the BOP, leaving a cleanly-cut pipe at the top of the BOP's LMRP. Live feed shows saws cutting/removing pipework and riser to allow easy access. The LMRP cap, an engineered containment device with a sealing grommet, would be connected to a riser from the Discoverer Enterprise drillship and then placed over the LMRP with the intention of capturing most of the oil and gas flowing from the well and transporting it to the drillship on the surface.

Two further containment strategies are planned:

- **Q 4000 Direct Connect**: this option will use the hoses and manifold that were deployed for the 'top kill' operation to take additional oil flow directly from the failed Deepwater Horizon blow-out preventer (BOP) through a separate riser to the Q4000 vessel on the surface. This system, currently expected to be available for deployment in mid-June, is intended to increase the overall efficiency of the containment operation by possibly increasing the amount of oil and gas flow that can be captured from the well.

- **Long-term Containment Option**: this operation will take oil from the LMRP via a manifold to a new free-standing riser ending approximately 300 feet below sea level. A flexible hose will attach it to a containment vessel at surface. This long-term option is designed to more effectively disconnect and reconnect the riser to provide the greatest flexibility for operation during a hurricane. Implementation is expected in late June or early July.

Dispersant injection on the sea floor – dispersant used subsea continues. EPA is allowing subsea application of the currently-used dispersant to continue.

Drilling relief wells

- The first relief well (work being performed by the *Development Driller III*) is at approximately 12,000 feet below sea level and drilling. This well was "spudded" on May 2.

- The second relief well (work being performed by *Development Driller II*) is at approximately 8,600 feet below sea level and drilling. Drilling began on May 16.

- Both wells are situated approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. It is estimated the total drilling process for each well will take at least 90 days

Offshore – Surface Spill Response

Cleanup Vessels – approximately 1,688 response vessels are now deployed (tugs, barges and recovery boats). 104 skimmers are in use.

Skimming Operations – 9,132 barrels of oily-water mix collected yesterday. Total to date = 329,842 barrels.

Surface Dispersant – Limited surface dispersant was used yesterday with 11,686 gallons applied.   Over 380,000 gallons of dispersant remain available.

In-Situ Burning – The Unified Command conducted an additional 17 in-situ burns on Monday. In-situ burning occurs on the surface using special fire-boom that collects surface hydrocarbons which are then burned.

Onshore - Shoreline Protection and Community Outreach

Shoreline Protection – Coast Guard and BP are redoubling efforts with additional senior operations managers coming into field locations to improve responsiveness and speed cleanup operations. The response organization has been restructured into three main branches - east, west and offshore. Additional forward operating bases and staging areas are being established in western Louisiana.

Shoreline Protection - Boom Report – over 1,961,445 feet of containment boom has been deployed (with an additional 624,077 feet staged). Over 2,085,590 feet of sorbent boom has been deployed (with an additional 1,747,460 feet staged)

Claims

- **Approximately 30,000 claims have been received. <u>Roughly 15,000 checks have been written, totalling $40 million</u>. Nearly 15,000 claims are awaiting documentation from claimants.**

- 500 claims adjustors are working across the Gulf Coast, 125 operators are answering phone calls.

ξ BP has 24 claims offices (across LA., MS., AL., FL.) open to help claimants through the process. Most claims are for loss of income or wages in commercial fishing, shrimping and oyster harvest, and associated facilities. Note: No person asserting a claim or receiving payment for interim benefits will be asked or required to sign a release or waive any rights to assert additional claims, to file an individual legal action, or to participate in other legal actions associated with the Deepwater Horizon incident. The contact number for claims is (800) 440-0858. In person claims can be filed at office locations listed below. Claims can also be filed online at: http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138

Total costs: the cost of the response to date amounts to about $990 million, including the cost of the spill response, containment, relief well drilling, grants to the Gulf states, claims paid and federal costs.

State specific websites established - BP today announced four informational web sites designed to offer state-specific (LA., MS., AL., FL) oil spill information to residents of communities affected by the Deepwater Horizon oil spill. Residents are encouraged to visit these sites frequently and sign up for the mailing list to receive the most current information about the spill response. These sites are dedicated to providing information about activities and events most important to residents of each state.

Alabama: www.alabamagulfresponse.com
Florida: www.floridagulfresponse.com
Louisiana: www.louisianagulfresponse.com
Mississippi: www.mississippigulfresponse.com

Independent Claims Mediator established - BP is appointing an Independent Mediator so that we have as fair a process as possible for everyone in the Gulf region. BP has always said will pay legitimate claims for loss and damage caused by the spill, and we're committed to paying claims promptly. In those cases in which a claimant and BP cannot agree on resolution of a claim, the mediator is a way for them to get an independent review.

$500 Million for 10-year Research Program to Study Spill Impacts – BP is contributing $500 million over 10 years to fund an open research program studying the impact of the Deepwater Horizon incident, and its associated response, on the marine and shoreline environment of the Gulf of Mexico. In coordination with other baseline efforts underway, BP will enter into programs with Louisiana State University, and other gulf coast research institutions, to establish a baseline of the coastal and marine ecosystem to serve as a control against which future impacts will be assessed.

BP Provides $70 million in Tourism Grants to States – BP has made $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism.

$25 Million Block Grants to 4 States – On May 4, BP announced it would provide Louisiana, Florida, Mississippi and Alabama $25 million each to accelerate implementation of the States' Area Contingency

Plans.

"Vessels of Opportunity" Program– Over 5,000 contracts have been signed and nearly 1,000 vessels are currently active. Community Outreach Centers are working with the contractors to ensure they have the appropriate training.

Volunteers and Training – 15,000 volunteers are registered. BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Volunteers are being trained in five different modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

Wildlife Activities – 10 new wildlife impacts reported yesterday. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

Summary of Regional Operations and Outreach			
Louisiana Sites:	Robert – Unified Area Command		
		Houma – Incident Command Post	
			Pointe A La Hache – Community Outreach Center
			Venice – Community Outreach Center, Staging Area
			Grand Isle – Staging Area
			Port Fourchon – Staging Area
			Cocodrie – Staging Area
			Shell Beach – Staging Area
			Slidell – Staging Area
			St. Mary – Staging Area
			Amelia – Staging Area
		Belle Chasse – **Claims Office** 2766 Belle Chasse Hwy Belle Chasse, LA 70037	
		Cut Off – **Claims Office** Tarpon Heights Shopping Center Unit 2 16263 E. Main Street Cut Off, LA 70345	
		Grand Isle – **Claims Office**	

	3811 LA 1 Grand Isle, LA 70358
	Hammond – **Claims Office** Worley Operations Center 303 Timber Creek Hammond, LA 70404
	Houma – **Claims Office** Plaza Caillou Shopping Center 814 Grand Caillou Road Suite 2 & 3 Houma, LA 70363
	New Orleans – **Claims Office** 4375 Michoud Blvd New Orleans, LA 70461
	Slidell – **Claims Office** 2040 Gause Blvd., Suite 10 Slidell, LA 70461
	St. Bernard – **Claims Office** 1345 Bayou Rd Saint Bernard, LA 70085
	Venice – **Claims Office** 41093 Hwy LA 23 Boothville, LA 70038

Mississippi Sites:	Pascagoula – Community Outreach Center, Staging Area
	Biloxi – Community Outreach Center, Staging Area
	Waveland – Community Outreach Center
	Pass Christian – Staging Area
	Bay St. Louis – **Claims Office**

	1171 Highway 90 Bay St. Louis, MS 39520
	Biloxi – **Claims Office** 920 Cedar Lake Rd, Suite K Biloxi, MS 39532
	Pascagoula – **Claims Office** 5912 Old Mobile Hwy Suite 4 Pascagoula, MS 39563

Alabama Sites:	Mobile – Incident Command Post, Community Outreach Center
	Theodore – Staging Area
	Orange Beach – Staging Area
	Dauphin – Staging Area
	Bayou LaBatre – **Claims Office** 13290 N. Wintzell Avenue Bayou LaBatre, AL 36509
	Foley – **Claims Office** (Orange Beach/Gulf Shores/Bon Secour) 1506 North McKenzie Street (HWY 59), Suite 104 Foley, AL 36535
	Gulf Shores / Orange Beach – **Claims Office** 24039 Perdido Beach Blvd Suite 1

	Orange Beach, AL 36561

Florida Sites:	St. Petersburg – Incident Command Post
	Pensacola – Community Outreach Center, Staging Area
	Panama City – Staging Area
	St. Joe – Staging Area
	St. Marks – Staging Area
	Apalachicola – **Claims Office** 194 14th Street Suite 105 Apalachicola, FL 32320
	Crawfordville – **Claims Office** 3010 Crawfordville Hwy Suite A&B Crawfordville, FL 32327
	Ft. Walton – **Claims Office** 348 SW Miracle Strip Pkwy Suite 13 Fort Walton Beach, FL 32548
	Gulf Breeze – **Claims Office** 5668 Gulf Breeze Pkwy Unit B-9 Gulf Breeze, FL 32563
	Panama City – **Claims Office** 7938 Front Beach Road Panama City Beach, FL 32408
	Pensacola – **Claims Office**

	3960 Navy Boulevard Suite 16-17 Pensacola, FL 32507
	Port St. Joe – **Claims Office** 106 Trade Circle Suite A Port St. Joe, FL 32456
	Santa Rosa Beach – **Claims Office** 5008 US Hwy 98W Unit 6&7 Santa Rosa Beach, FL 32459

Contact Information	
Environment / Community Hotline – to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife – to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers – to request volunteer information	(866) 448-5816
Services – to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity – to report and register boats available to assist with response	(281) 366-5511
Training – for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit – File online at http://www.horizonedocs.com/index.html	
Investor Relations	(281) 366-3123
Claims – by phone	(800) 440-0858
Claims – http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138	
Joint Information Center – Robert, LA – Media and information center	(985) 902-5231 or (985) 902-5240
Joint Information Center – Mobile, AL – Media and information center	(251) 445-8965
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765
BP Family – and third-party contractor hotline	(281) 366-5578
Twitter: Oil_Spill_2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

BP America

Sr. Director, Regulatory Affairs

[redacted]

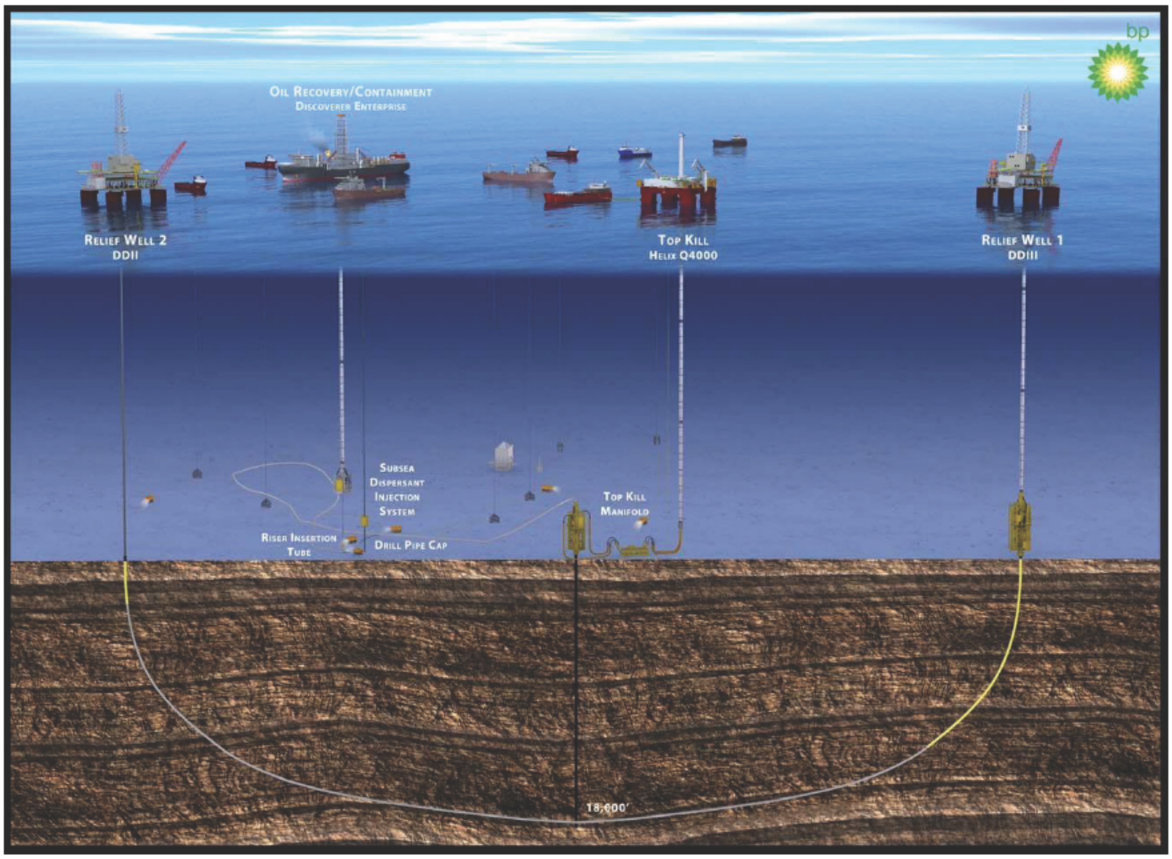
[redacted] (cell)

stjohnk@bp.com

Technical Briefing

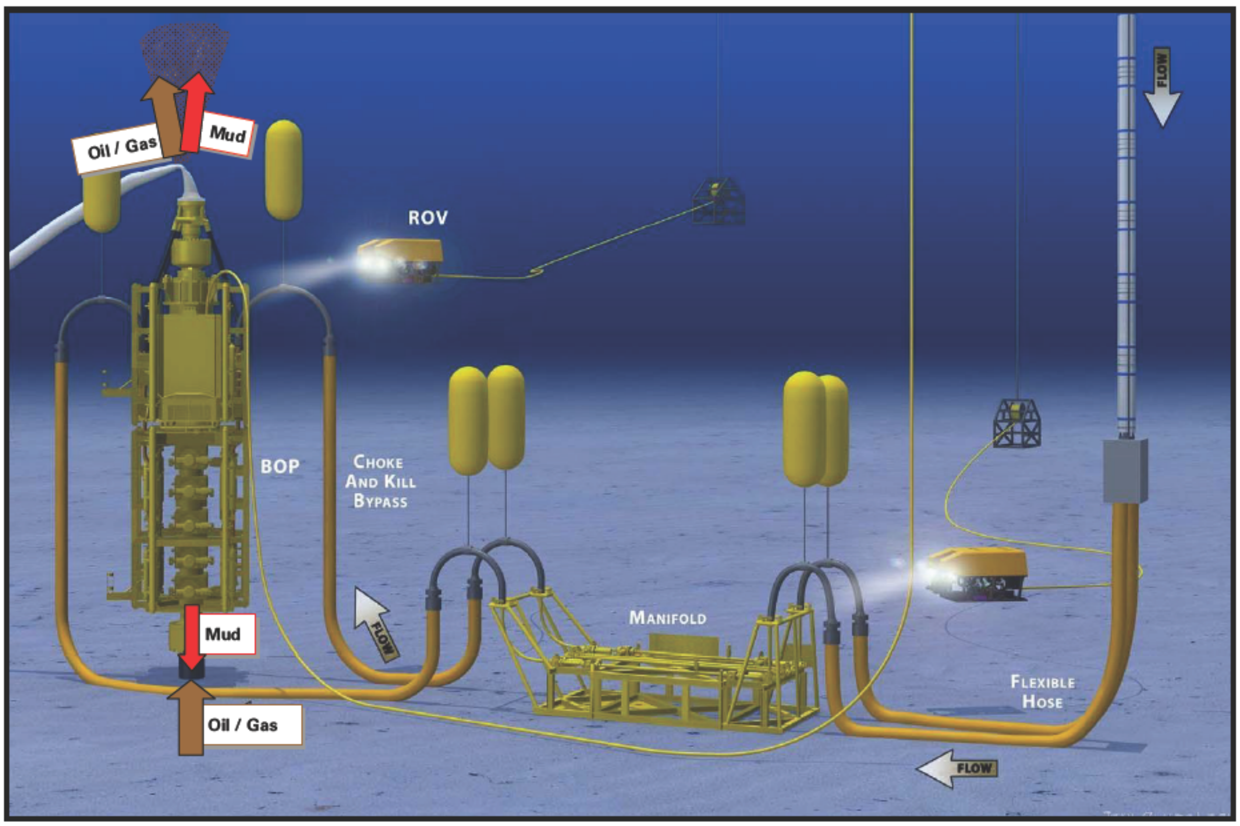
Kent Wells

Deepwater Horizon Incident Response Update



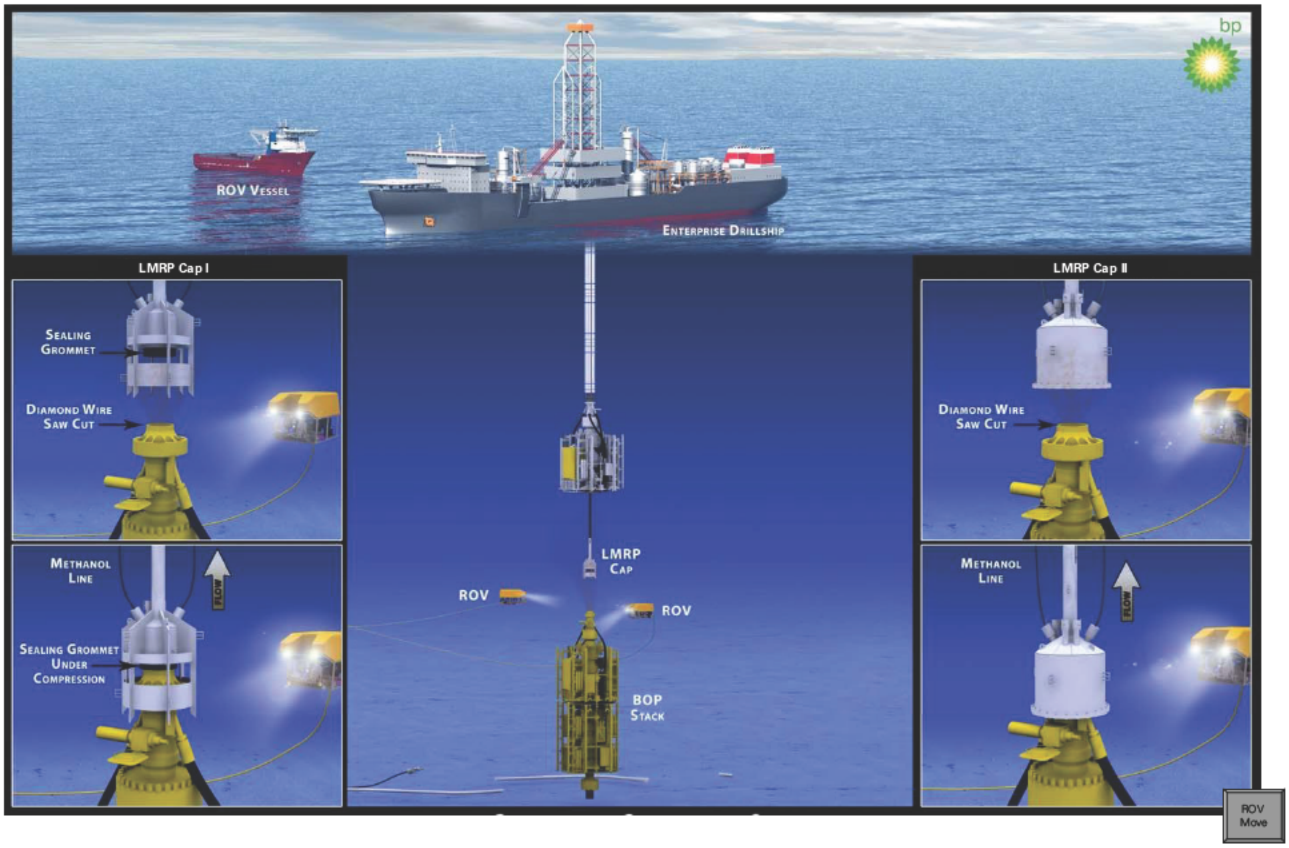
Document ID: 0.7.19.1654.1

Top Kill Results

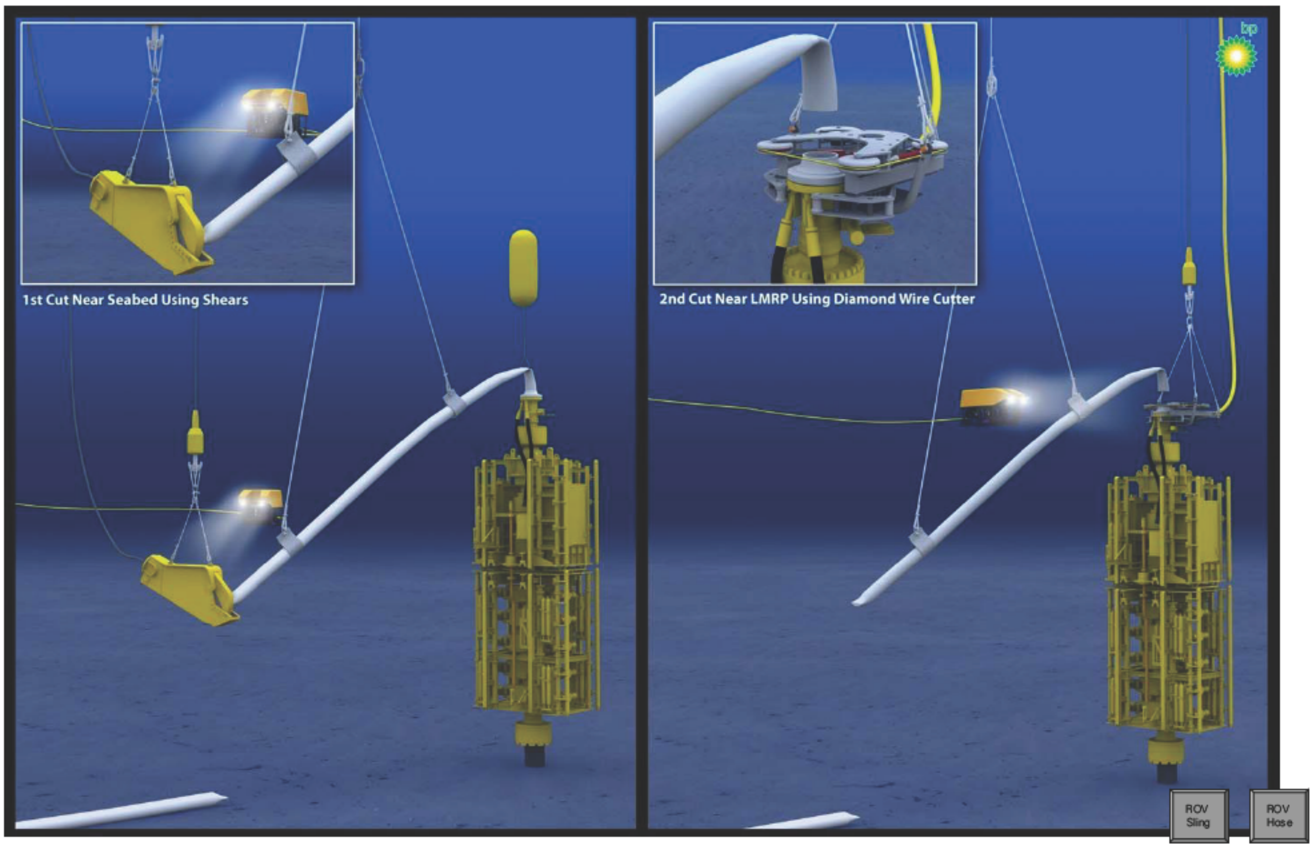


Document ID: 0.7.19.1654.1

LMRP Cap I and II



Riser Removal – 2 Step Process



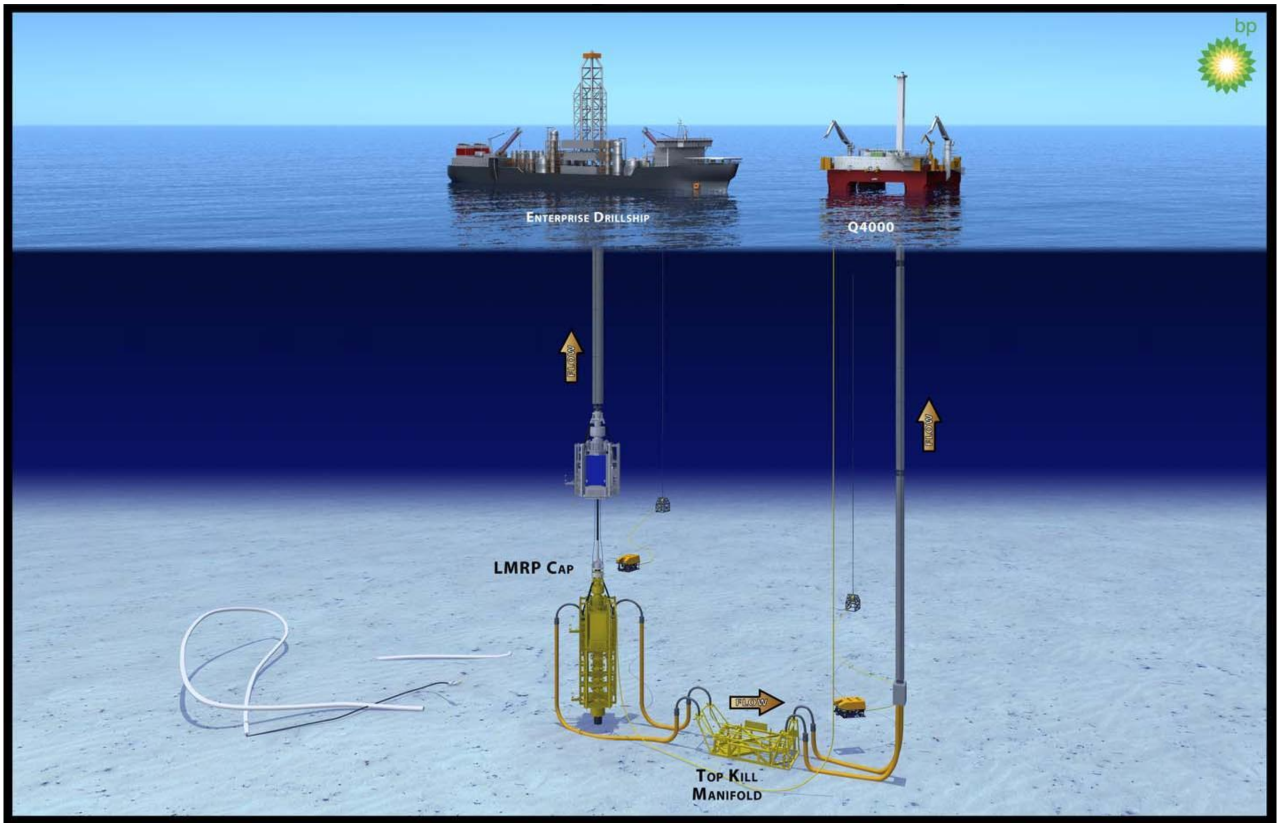
Photos of Equipment

Diamond Saw

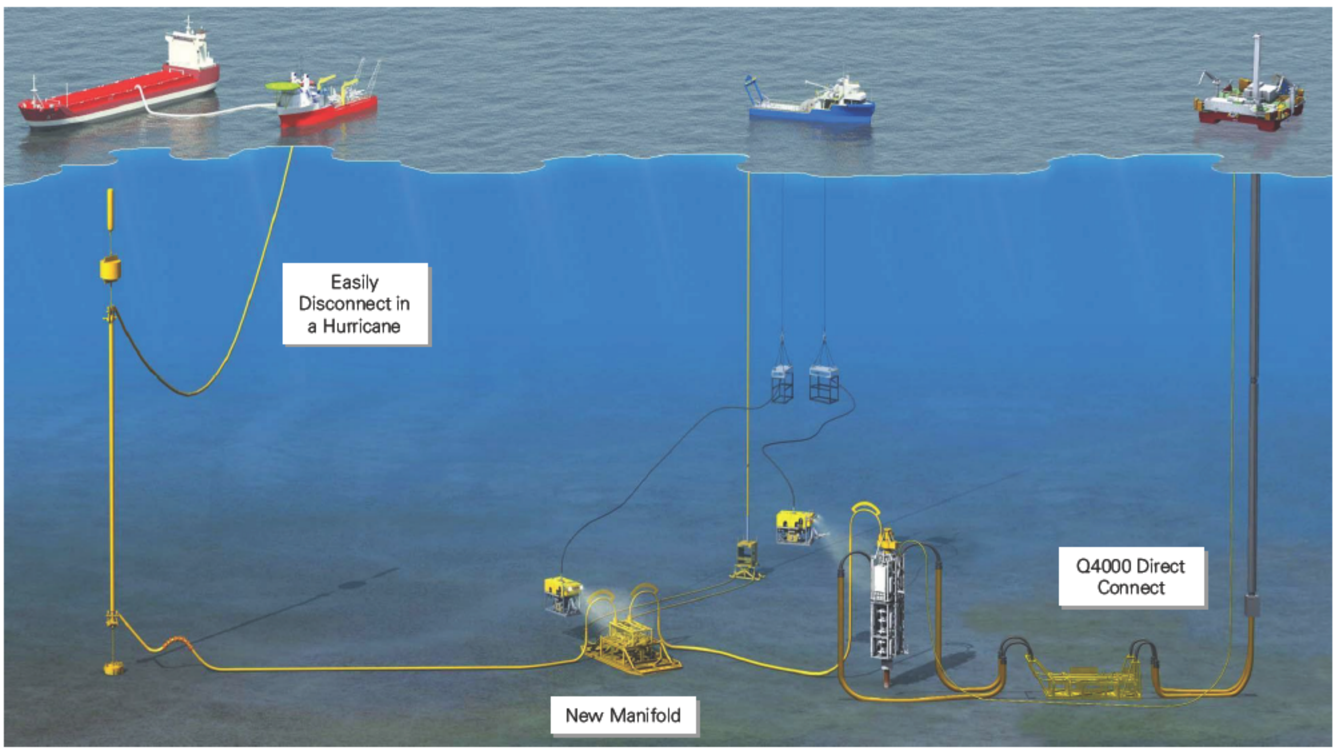
LMRP Cap Prior To Deployment

Shears

Double Containment:
LMRP Cap w/ Q4000 Direct Connect



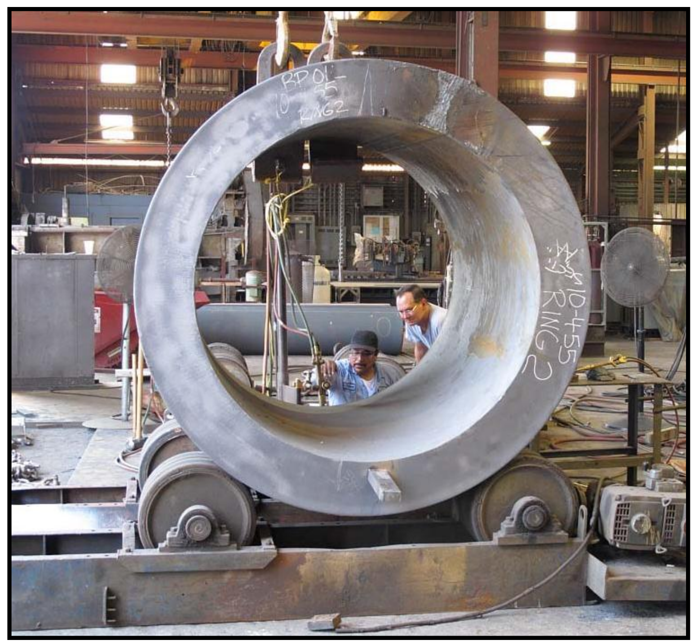
Long Term Containment



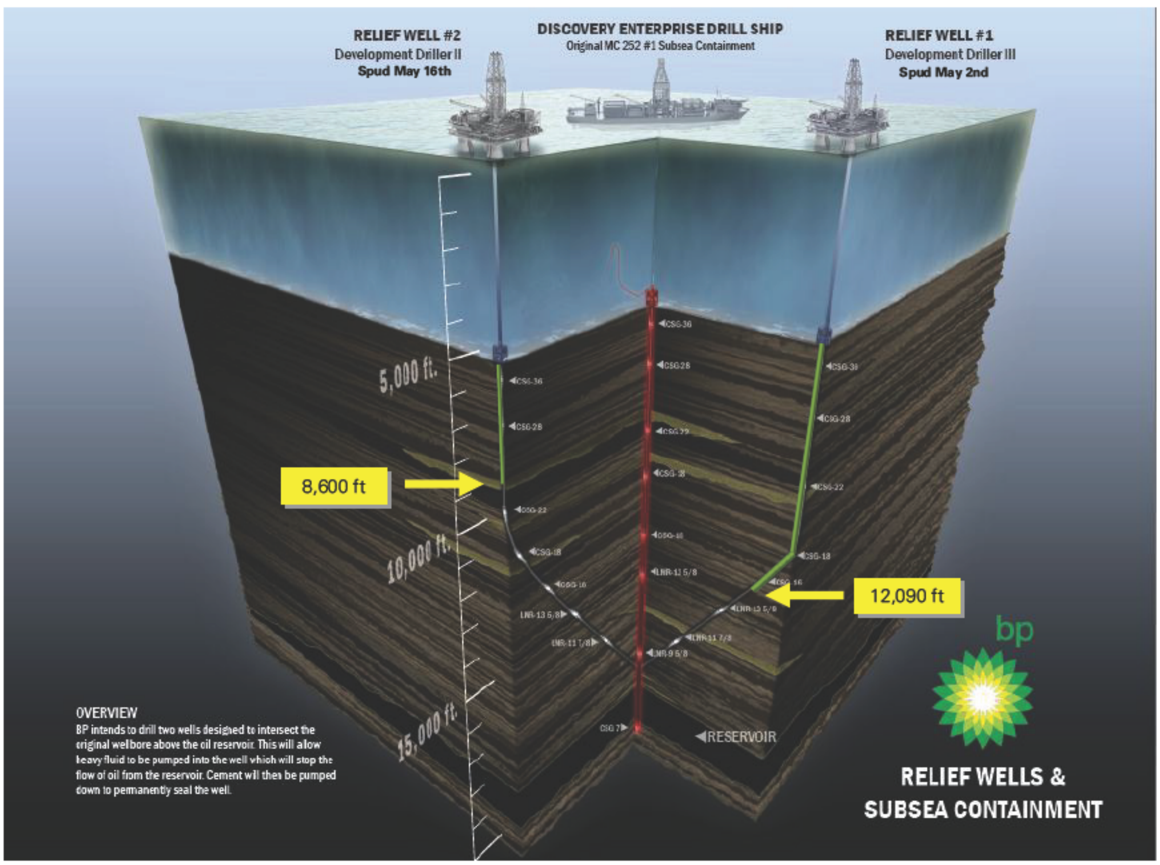
Long Term Containment Fabrication

Buoyancy Can

Overshot Tool

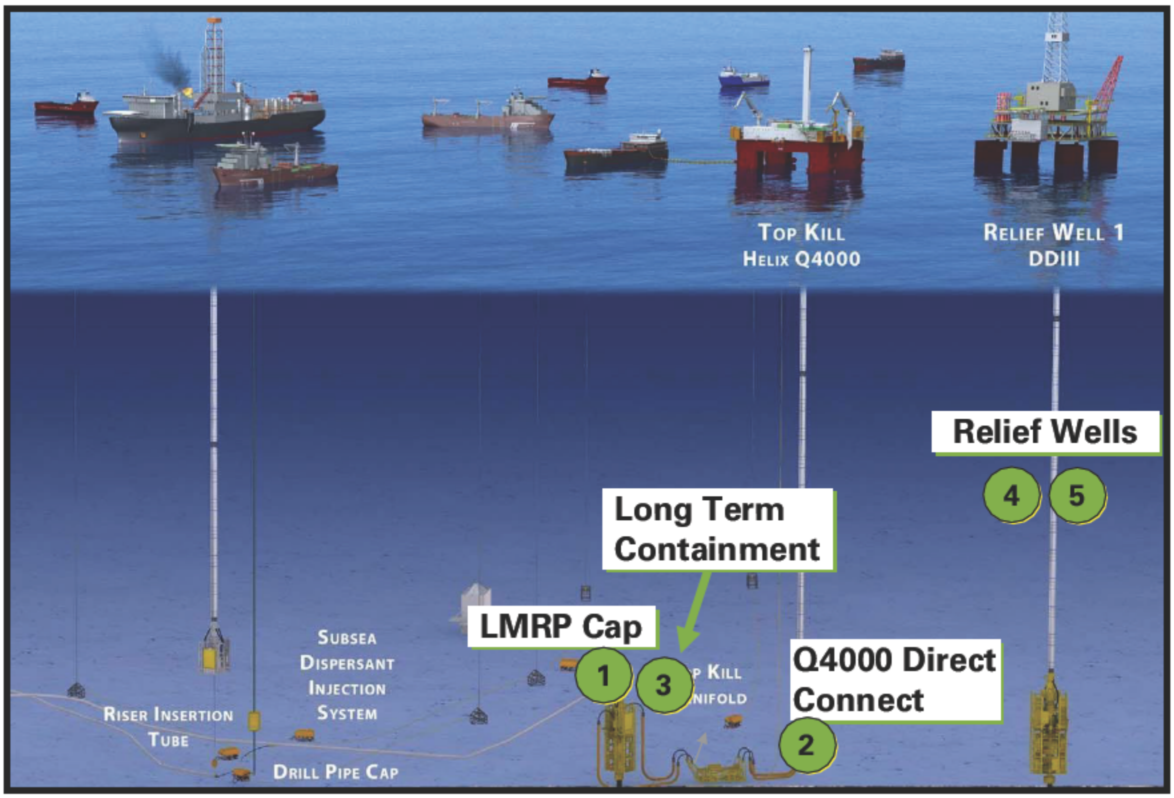


Relief Well Progress



Document ID: 0.7.19.1654.1

Multiple Containment and Relief Efforts Continue



Best and Brightest – Relentless at the Task

Received(Date): Wed, 02 Jun 2010 07:58:53 -0400
From: Tim Gallagher <timothy.gallagher@noaa.gov>
Subject: Morning notes
To: dwh.staff@noaa.gov
Cc: Ken Barton <Ken.Barton@noaa.gov>
Daily Update DWH-MC252 - 2JUN10.docx

Good Morning! Please see attached for this morning's notes. --Tim

Yesterday afternoon oil in the form of mousse-like tarballs began impacting the SW shore of Petit Bois Island. The expansive field of tarballs, tarmats and tar paddies stretched as far east as Perdido Key according to overflight observations. Predicted S to SW winds will continue to push that oil shoreward during the forecast period. Oil examined about 45 miles offshore Alabama appeared highly viscous somewhat different than the typical emulsified moussey-textured product.

Trajectories also suggest that Timbalier & Barrataria Bays should anticipate shoreline impacts as the week progresses. Because these areas were hit hard during the last period of onshore winds, anticipate attention to refocus on marsh mitigation & cleanup procedures. SCAT guidelines already address the sensitivities of these unique habitats and represent compromises between immediate cleanup and preserving their integrity.

Aerial dispersant applications were suspended again yesterday as BP investigated the complaints of ill health from adjacent drilling platforms nearly 80 miles away. Erring on the side of safety, BP stated that they take all complaints seriously. Amid those health concerns and the approaching oil, discussions began in sector Mobile about using dispersants nearer to shore as compared to Louisiana. The reduced efficacy of dispersants against highly weathered oil should be the limiting factor.

With fluorometers the Pelican reported finding submerged oil in vicinity of the source at approximately 1000m deep. Additionally they collected water samples that visibly appeared to contain oil. This is consistent with the reports of the several other research vessels transecting the area. Prior to their departure, NOAA provided the Pelican crew with water sampling guidelines which recommends specific collection containers and preservation techniques. As a result, we anticipate their samples to provide a productive analysis.

Yesterday NOAA participated in the briefing of the Cuban government concerning the trajectories, fate & characterization of oil in the Gulf. DoS essentially led from the previously determined brief. Overall it seemed to be well received. Cuba expressed interest in being included in the Science Summit later this week.

Yesterday BP began preparations for installation of the Lower Marine Riser Package Top Hat/Cap. The riser was crimped & cut at the seafloor about 100 ft downstream of the BOP. Still waiting for confirmation concerning the success of the upper cut of the riser just above the BOP.

Received(Date): Wed, 02 Jun 2010 12:04:02 -0400
From: Joe Inslee <Joe.Inslee@noaa.gov>
Subject: Notes from June 2, 11 AM NRT Call
To: NOAAHQ.Leadership@noaa.gov, Policy.Contacts@noaa.gov,PCO.Contacts@noaa.gov, dwh.staff@noaa.gov, David.Kennedy@noaa.gov,KSarri@doc.gov

Morning-
Below are notes from the June 2, 11 AM NRT call

FOR OFFICIAL USE ONLY

National Response Team Call
June 2, 2010
11:00 AM

The next NRT meeting is June 3 at 11 AM.

Situation Status:

- The initial cut of the riser pipe has been made. A second cut is currently halted because the cutting blade is "pinched" in the pipe. Operations are trying to deciding how to deal with this issue.

- The relief wells remain at approx 12,000 and 8,000 ft below sea level.

- Skimming operations recovered approximately 9,000 bbls of an oil/water mix yesterday. Skimming operations continue today.

- Approximately 2,500 surface and 13,000 of sub-surface gallons of dispersants were applied yesterday. These operations will continue today.

- 4 burns occurred yesterday, these will be attempted again today but the sea state is becoming more active.

Intergovernmental Affairs Update:

- Gov. Riley continues to express concerns over a lack of resources.

- The feedback from the Parish Presidents liaison program is receiving positive feedback

Congressional Affairs

- Today there are scheduled briefings with the Appropriations committee regarding the emergency fund.

Legal Affairs

- A few weeks back Trans Ocean filed a claim attempting to limit their liability under old maritime laws. Last night the Federal Government filed opposition to this request stating that their liability should fall under more recent and appropriate laws such as OPA 90.

Joe Inslee
Policy/Outreach Assistant
Assessment and Restoration Division
NOAA Office of Response and Restoration
1305 East West Highway SSMC 4, Rm. 10219
Silver Spring, MD 20910 Office [redacted] ext. 202
Cell [redacted]
Fax [redacted]

Received(Date): Wed, 02 Jun 2010 15:29:42 -0400
From: Beth Dieveney <Beth.Dieveney@noaa.gov>
Subject: (no subject)
To: "'John.Rapp@noaa.gov'" <John.Rapp@noaa.gov>
NOAA_Science_Summit 2 pager Final.doc

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Beth Dieveney
NOAA Program Coordination Office
Office of the Under Secretary
14th & Constitution Ave., NW, Room 5811
Washington, DC 20230

phone: [redacted]
cell: [redacted]
fax: [redacted]

SCIENCE IN SUPPORT OF DEEPWATER HORIZON OIL SPILL RESPONSE

NOAA

http://response.restoration.noaa.gov
http://www.aoml.noaa.gov/phod/dhos/index.php

Introduction

Authorities for NOAA's role:

- Scientific support to U.S. Coast Guard (USCG) under the Oil Pollution Act of 1990 (OPA-90): NOAA provides scientific support to USCG in their role as Federal On-Scene Coordinator (FOSC) for Oil Spill Response Actions
- Seafood Safety Management under Magnuson-Stevens Fishery Conservation and Management Act (MSRA).
- Living Marine Resource protection under MSRA, Marine Mammal Protection Act (MMPA), and Endangered Species Act (ESA) as well as other statutes such as the Fish and Wildlife Coordination Act. Marine Health and Stranding Response Act
- Natural Resource Damage Assessment under OPA-90: NOAA, as a Trustee for natural resources, works with other federal and state trustees to assess the injuries to natural resources from the oil spill and the oil spill response actions.
- Oceans and human health effects, including effects on ecosystem health, marine organism health, and human health under Oceans and Human Health Act, Harmful Algal Blooms and Hypoxia Research and Control Act.

Immediate Actions (event to 2 months)

NOAA is providing scientific support to the Response Incident Command, through the USCG FOSC. This includes daily trajectories for fate and transport of surface oil, higher resolution of the interaction between surface oil and the Loop Current, daily predictions of shoreline oil impacts, on-scene assessment of shoreline oiling through overflights and Shoreline Cleanup and Assessment Technology Technique (SCAT) models describing likely fate and transport of oil dispersed at the well head, daily observations and evaluations of marine mammal and turtles, estimates of oil flow rates, organization of scientific data, and ongoing science briefs to local, state, and national groups. NOAA currently staffs command posts in Robert LA, Houma LA, Venice LA, Mobile AL, St. Petersburg FL, Miami FL, and Key West FL. NOAA also has a scientific support group in Seattle WA and provides staff for the National Incident Command in Washington, DC. As of the end of May, NOAA has four aircraft, two NOAA ships, and is supporting/has supported five contract ships involved in this incident. Additionally, through partnerships, NOAA is supporting several additional cruises and is working closely with non-federal as well as federal partners in coordinating information derived from a fleet of AUVs and gliders operating throughout the northeastern Gulf of Mexico.

NOAA is closing federal waters to fishing based on oil trajectories, initiating training for seafood safety assessment for oil and dispersant contamination - via both organoleptic and chemical analyses - and collecting untainted seafood for these tests and trainings. As a Trustee for natural resources, NOAA is working with USFWS, NPS, DoD, LA, MS, AL, FL, and TX to collect samples of both baseline and impacted resources. To date, over 2000 were collected.

A summary of past and on-going NOAA immediate response actions include:

- Scientific support to the Incident Command through the USCG FOSC;
- Collecting a broad suite of Mussel Watch and other samples for determination of baseline environmental conditions immediately prior to coastal/shoreline contamination by the DWH oil;
- Assessing the safety of seafood and inform appropriate closures of federal waters;
- Evaluating dispersant and oil related to seafood safety – conduct baseline contaminant studies and include post-Katrina data;
- Calculating oil flow from the DWH site to estimate total release of oil;
- Tracking surface oil and dispersant fate and transport;
- Measuring distribution and magnitude of subsurface dispersed oil and dispersant through acoustics, fluorescence studies, water sampling, and other technologies with NOAA Research Vessels and partners, Participate in interagency Joint Analysis Group (JAG);
- Measuring impact of subsea dispersed oil on hypoxia events;
- Conducting aerial surveys of protected species distribution and abundance;
- Updating state of the Loop Current hydrodynamics – aircraft deployed ocean profilers and oceanographic cruises;
- Conducting baseline studies of natural resources (water, sediment, biota, human use);
- Developing and conducting studies to measure injuries of trust resources (water, sediment, biota, human use) by oil and or response actions; and,
- Initializing studies on effects of dispersants on marine organisms

Near-Term Actions

Assuming oil continues to flow from the well head through August, many of the near-term actions will look similar to the immediate actions. Some longer-term NOAA studies may be developed and undertaken, such as those designed to demonstrate and quantify oceanographic observations and modeling to predict trajectories, injury to natural resources, continued testing of seafood for fishery closure and seafood safety considerations, and studies to gain higher resolution on extent and fate of subsea dispersed oil. Restoration planning will likely commence.

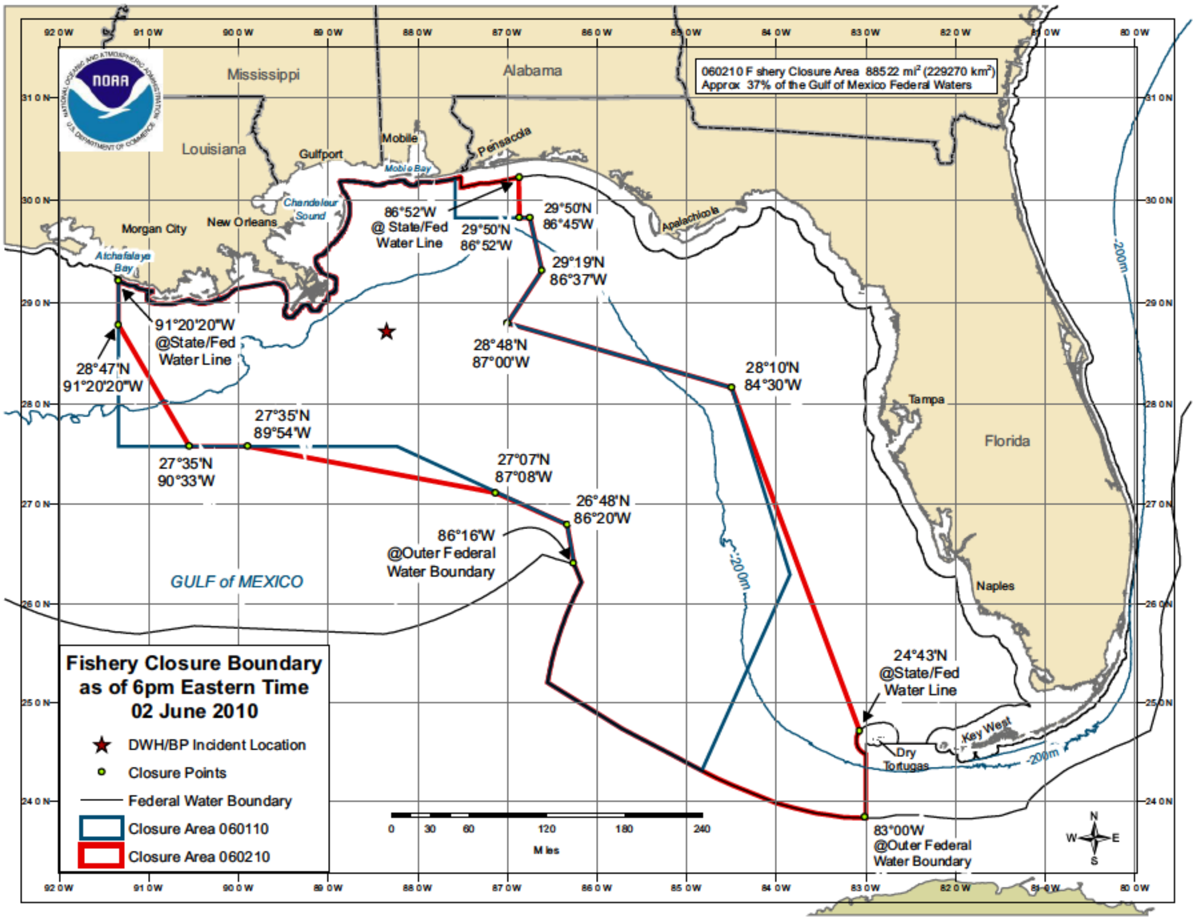
- Continued scientific support to the IC through USCG FOSC (including trajectory predictions, Loop Current evaluation, predicted shore line impacts, etc.).
- Mass balance calculations to understand surface and sub-surface fractions of total release

- Continued assessment of shoreline oil impacts and support for scientifically appropriate clean-up actions.
- Continued surveys to assess the magnitude, characteristics, fate, transport and near-term effects of subsurface dispersed oil
- Surveys of potential oil and dispersants in seafood species in closed and open areas
- Identification and initiation of studies to quantify natural resource injuries.
- Additional human dimensions studies to understand the impact of the event on coastal community, including outreach efforts by Sea Grant
- Exploring novel mechanisms for engaging the broader scientific community

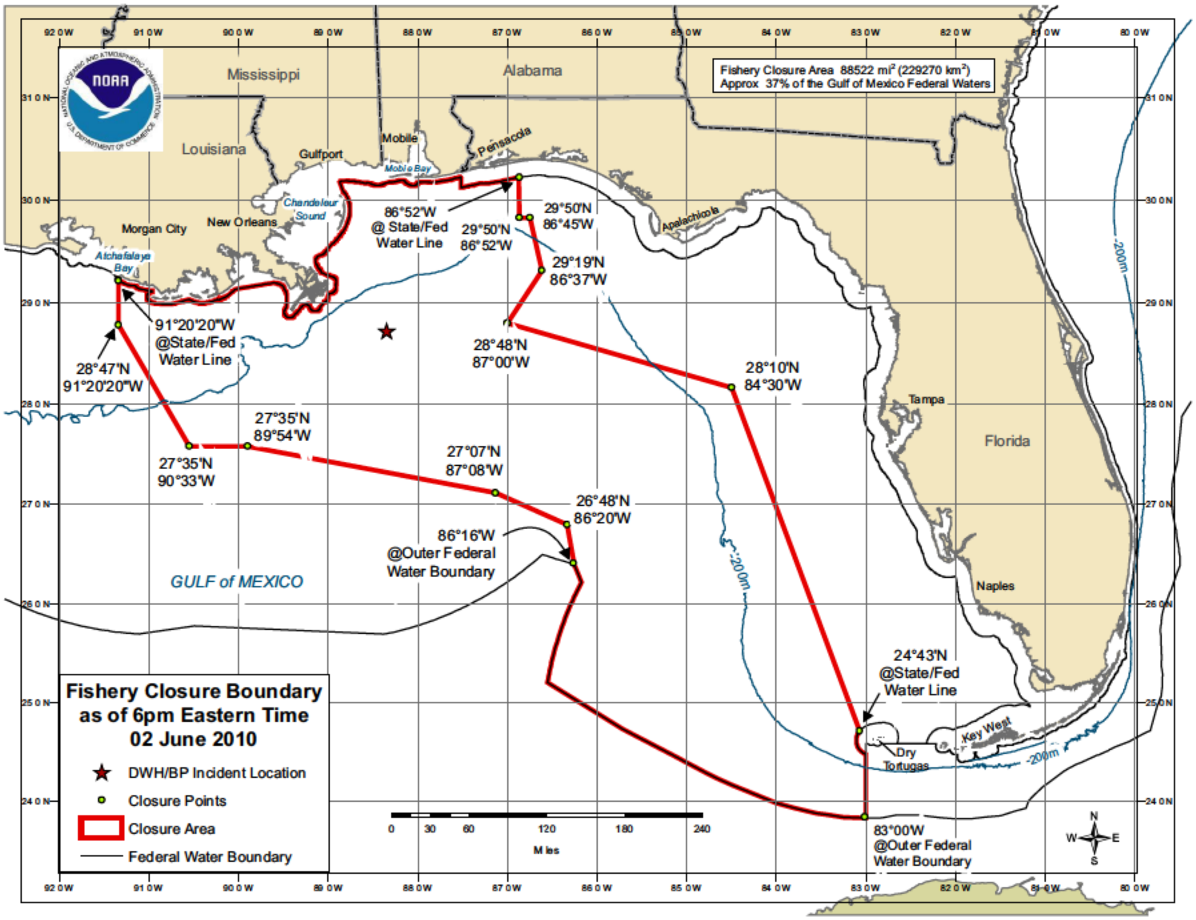
Long-Term Actions (2 months-decadal)

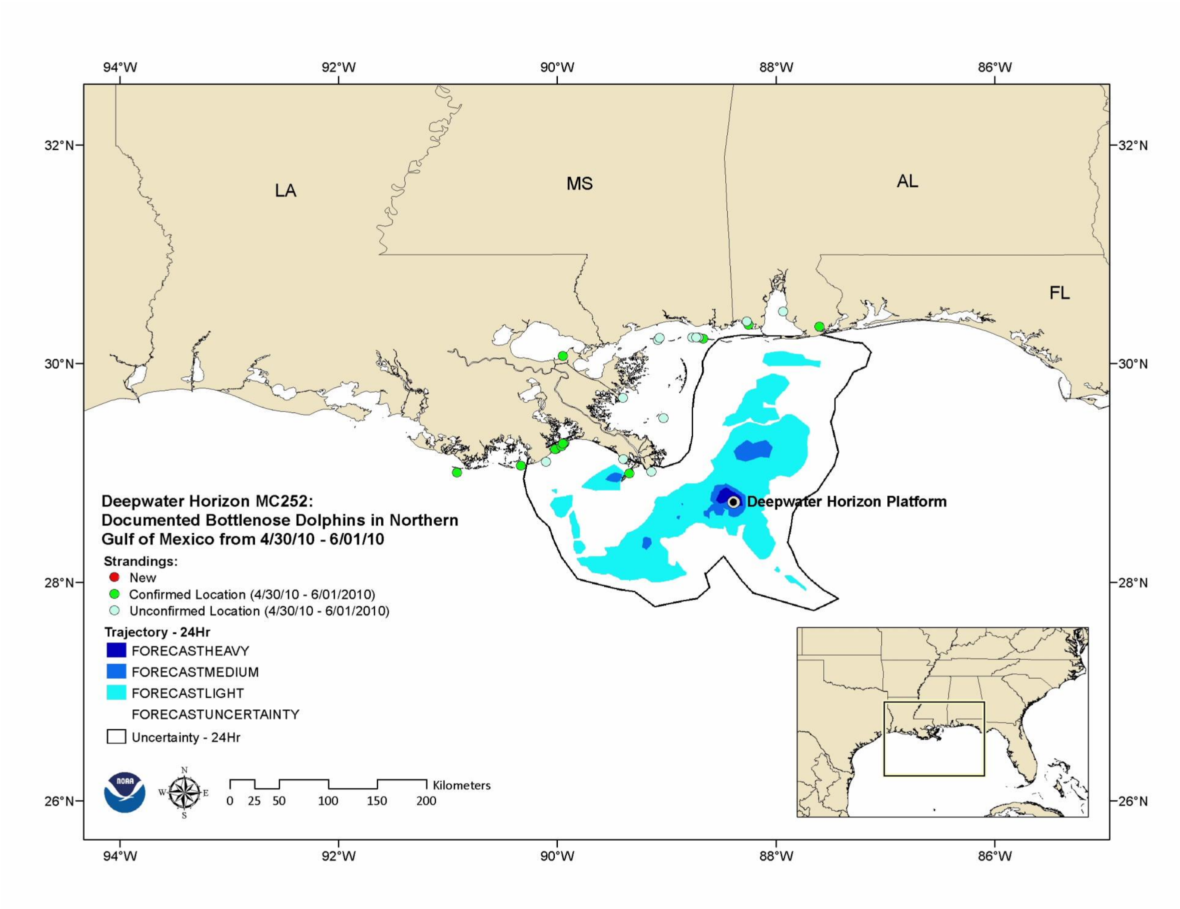
Long-term impacts of the spill are likely ecosystem-wide, with particular relevance to various habitat types from salt marshes to deep coral/biogenic communities to human communities. Studies are needed to establish baselines, which are essential to determine the extent of natural resource damages. These studies and baselines include:

- Natural Resource Damage Assessment injury studies;
- Long-term studies of impacted areas, salt marsh productivity, species composition, and geochemistry;
- Ecosystem level restoration needs and opportunities along the northern GOM;
- Long-term assessment of surface ocean productivity (e.g., following the long-term impact(s) to neuston) including ecosystem-wide impacts;
- Long-term impacts to deep communities (e.g., deep water corals);
- Long-term connections between dispersed oil and GOMEX hypoxia events;
- Planning for and initiation of long-term ecosystem and socio-economic impact studies;
- Effects of oil, dispersants, and dispersant-oil mixtures at the surface, sub-surface and atmosphere on LMR and ecosystem processes, productivity, and services; and,
- Effects on key habitats and natural biodiversity, with special emphasis on coastal wetlands and estuarine nursery areas.

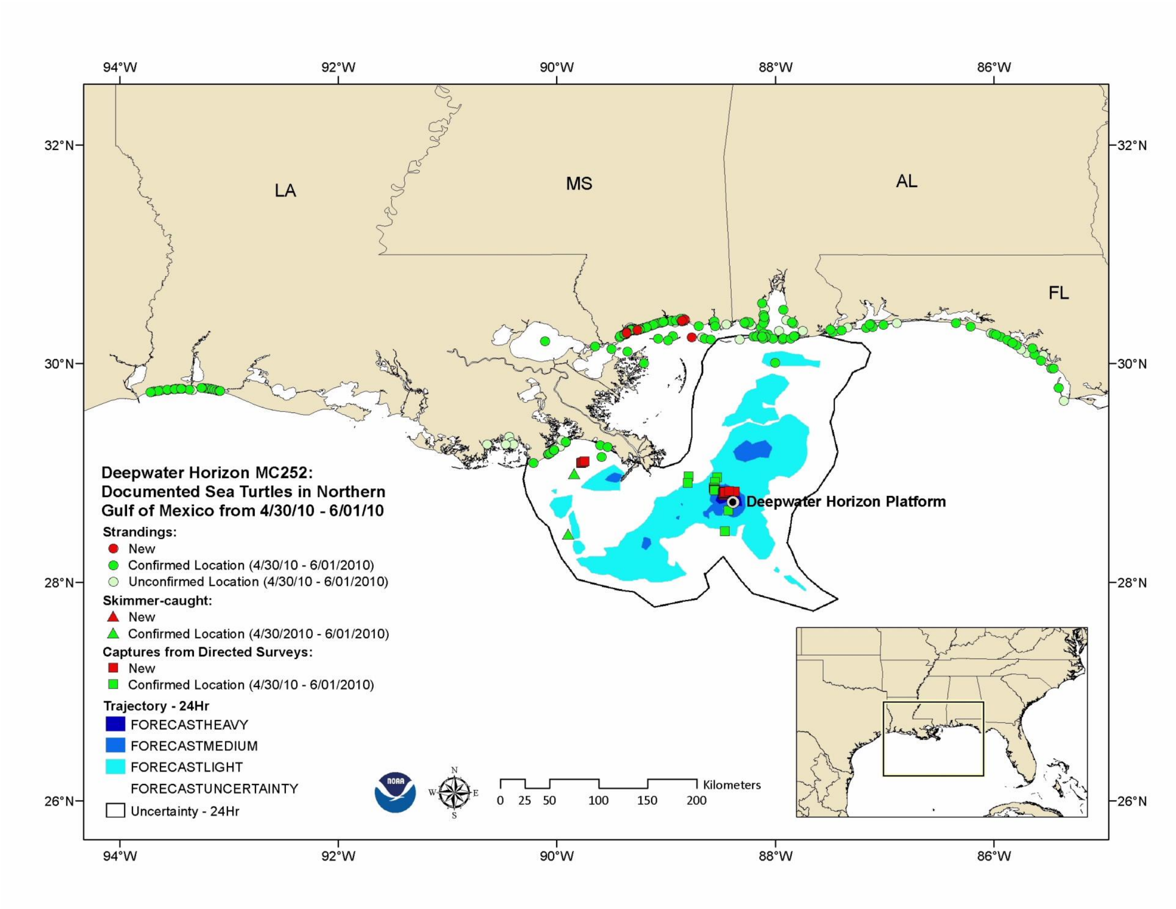


060210 Fishery Closure Area 88522 mi² (229270 km²)
Approx 37% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Louisiana
Florida
GULF of MEXICO
Fishery Closure Boundary
as of 6pm Eastern Time
02 June 2010
DWH/BP Incident Location
Closure Points
Federal Water Boundary
Closure Area 060110
Closure Area 060210


Fishery Closure Area 88522 mi² (229270 km²)
Approx 37% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Louisiana
Florida
Mobile
Pensacola
Gulfport
Mobile Bay
Chandeleur Sound
New Orleans
Morgan City
Atchafalaya Bay
Apalachicola
Tampa
Naples
Key West
Dry Tortugas
GULF of MEXICO
86°52'W
@ State/Fed
Water Line
29°50'N
86°52'W
29°50'N
86°45'W
29°19'N
86°37'W
28°48'N
87°00'W
28°10'N
84°30'W
91°20'20"W
@State/Fed
Water Line
28°47'N
91°20'20"W
27°35'N
89°54'W
27°35'N
90°33'W
27°07'N
87°08'W
26°48'N
86°20'W
86°16'W
@Outer Federal
Water Boundary
24°43'N
@State/Fed
Water Line
83°00'W
@Outer Federal
Water Boundary
-200m
Fishery Closure Boundary
as of 6pm Eastern Time
02 June 2010
DWH/BP Incident Location
Closure Points
Closure Area
Federal Water Boundary
0 30 60 120 180 240
Miles



94°W
92°W
90°W
88°W
86°W
32°N
30°N
28°N
26°N
LA
MS
AL
FL
Deepwater Horizon Platform
Deepwater Horizon MC252:
Documented Bottlenose Dolphins in Northern
Gulf of Mexico from 4/30/10 - 6/01/10
Strandings:
New
Confirmed Location (4/30/10 - 6/01/2010)
Unconfirmed Location (4/30/10 - 6/01/2010)
Trajectory - 24Hr
FORECASTHEAVY
FORECASTMEDIUM
FORECASTLIGHT
FORECASTUNCERTAINTY
Uncertainty - 24Hr
Kilometers
0 25 50 100 150 200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92°W
90°W
88°W
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32°N
30°N
28°N
26°N
LA
MS
AL
FL
Deepwater Horizon Platform
Deepwater Horizon MC252:
Documented Sea Turtles in Northern
Gulf of Mexico from 4/30/10 - 6/01/10
Strandings:
New
Confirmed Location (4/30/10 - 6/01/2010)
Unconfirmed Location (4/30/10 - 6/01/2010)
Skimmer-caught:
New
Confirmed Location (4/30/2010 - 6/01/2010)
Captures from Directed Surveys:
New
Confirmed Location (4/30/10 - 6/01/2010)
Trajectory - 24Hr
FORECASTHEAVY
FORECASTMEDIUM
FORECASTLIGHT
FORECASTUNCERTAINTY
Uncertainty - 24Hr
Kilometers
0 25 50 100 150 200

Science Summary Related to the DWH-MC-252 OIL SPILL

NOAA

June 3, 2010

Dr. Jane Lubchenco, Administrator

CHARLIE CRIST
GOVERNOR

June 2, 2010

Secretary Gary Locke
U.S. Department of Commerce
1401 Constitution Avenue, NW
Washington, DC 20230

Dear Secretary Locke:

On behalf of the fishing industries and related businesses of Florida, I am writing to request that you make a determination of a commercial fishery failure in Florida under the provisions of Section 312(a) of the Magnuson-Stevens Fishery Conservation and Management Act. I request this determination based on the growing impact of the Deepwater Horizon oil spill on the fishing communities throughout this state. As I write this letter, we have been fortunate to have been spared the direct impacts of oil on our beaches and in our state waters. However, as more of the Gulf of Mexico's federal waters are closed to fishing and the spill continues unabated, there are now two immediate and devastating impacts to our fishing industries and the men and women who work so hard at their livelihoods.

First, from the outset of the spill, news reports helped foster the mistaken impression that the entire Gulf of Mexico has been tainted by the oil spill. This misinformation has affected tourism and seafood consumption in Florida and resulted in severe economic impacts throughout the state. Second, with expanding fishery closures and the recent movement of oil towards the Florida Panhandle, we are now faced with the direct impact of lost fishing opportunities. Just today, in response to the movement and detection of oil, NOAA Fisheries Service expanded its federal fishery closure to include a significant portion of the commercial fishing grounds for snapper and grouper species off the west coast of peninsular Florida. This action alone will have a severe and immediate economic impact on Florida's commercial grouper fleet. Our commercial harvesters are already having trouble selling product because of the unfounded fear that seafood from the gulf is contaminated. Clearly, our commercial fishing industry is suffering a failure from the Deepwater Horizon spill.

However, the impacts go beyond what our commercial fishermen are experiencing. Mainly due to the misperceptions and misinformation about the extent and impact of the spill, Florida's charter fishing fleet, for-hire guides, and related fishery infrastructure are also suffering. The State of Florida will continue to do everything possible to promote fishing and seafood safety, but our fishermen and coastal fishing communities are already seeing serious economic damages. To address these additional impacts, I urge you to also establish a regional economic transition program under the provisions of Section 315 of the Magnuson-Stevens Act.

THE CAPITOL
TALLAHASSEE, FLORIDA 32399 • (850) 488-2272 • FAX (850) 922-4292

I will continue to hold British Petroleum fully accountable to the people of Florida for this devastating spill. However, Florida needs your help and that of Congress to ensure that every possible safety net is in place for our fishing industries and communities. Please act on this urgent request. I look forward to working with you in our mutual efforts to overcome the impacts of this devastating oil spill.

Sincerely,

Charlie Crist

Seafood Safety Daily Report
Reported from Seafood inspection Program, National Seafood Inspection Laboratory and Northwest Fishery Science Center
Wednesday, June 2, 2010

Seafood Inspection Program (SIP):

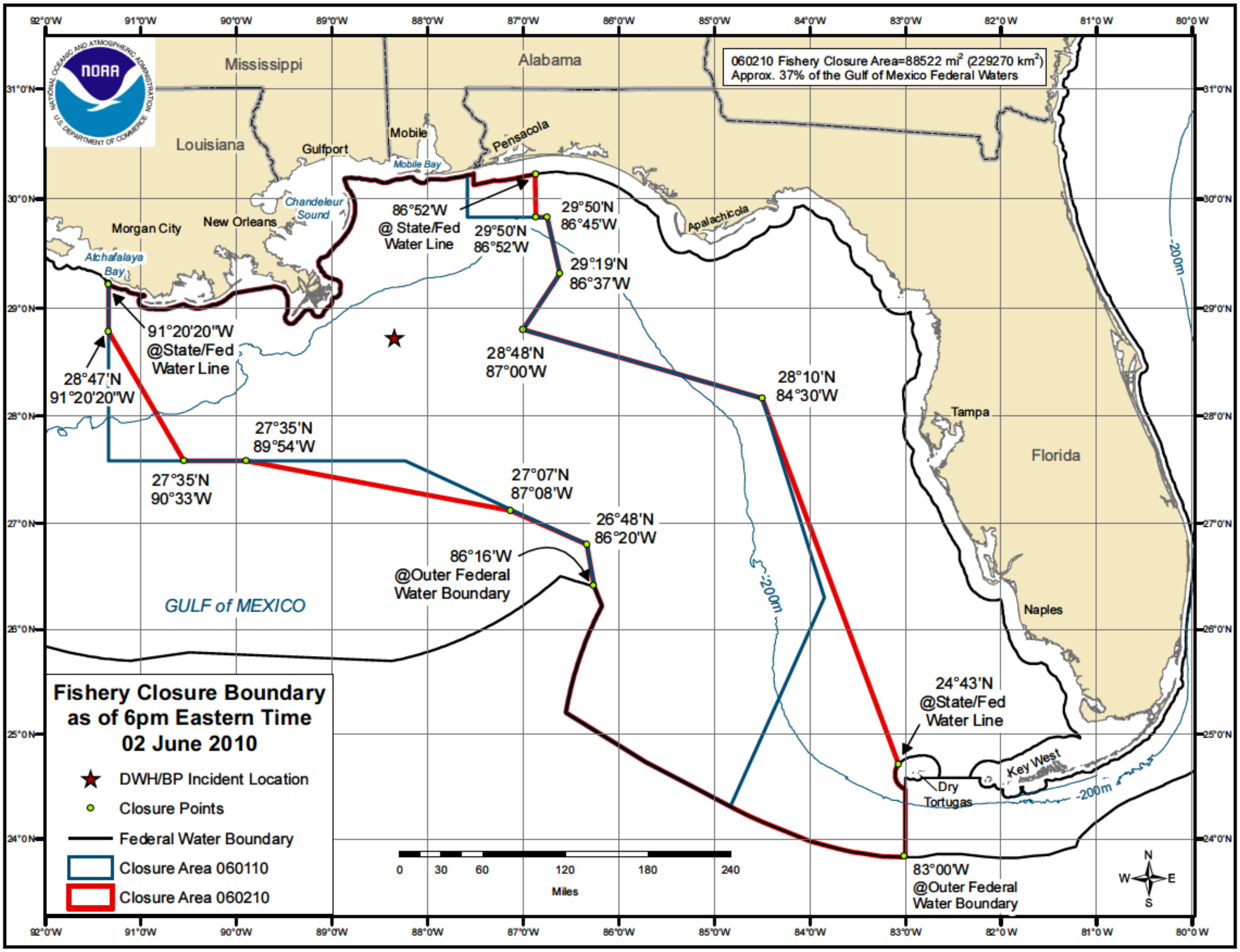
- SIP sensory experts began the first of the State sensory training sessions today in Pascagoula, MS on Tuesday. This first class has 20 participants from MS, AL, and TX. Two other sessions are planned for next week again in Pascagoula.
- Steven Wilson is revising the surveillance protocol for final review by the seafood safety team and NMFS management.

Northwest Fishery Science Center (NWFSC):

- Analysis of seafood samples including finfish, shrimp and oysters for PAH contamination is continuing.
- NWFSC staff are adding sensory data to the seafood safety information for the internal website

National Seafood Inspection Laboratory

- Summary & Status of samples: 416 field samples processed and shipped to NWFSC for PAH analysis, 118 field samples provided to SIP for sensory analysis, 640 field samples received from 18 vessel trips, 224 field samples to be processed.
- Processing baseline trawl samples provided by Dauphin Island Sea Lab collected 5/3/10.
- Working with SEFSC biologists to identify species collected in baseline trawl samples during Simple Man Cruise (a few weeks) ago.
- No new field samples coming in today.
- Hosting SIP Sensory Analysts and FDA representatives.
- Hosting state personnel for SIP sensory training started today.
- Working out logistical problems with SEFSC on obtaining GIS mappings of sampling locations vs. cruise tracks in order to facilitate combining seafood species samples from nearby sites into amounts needed to perform sensory analysis on.



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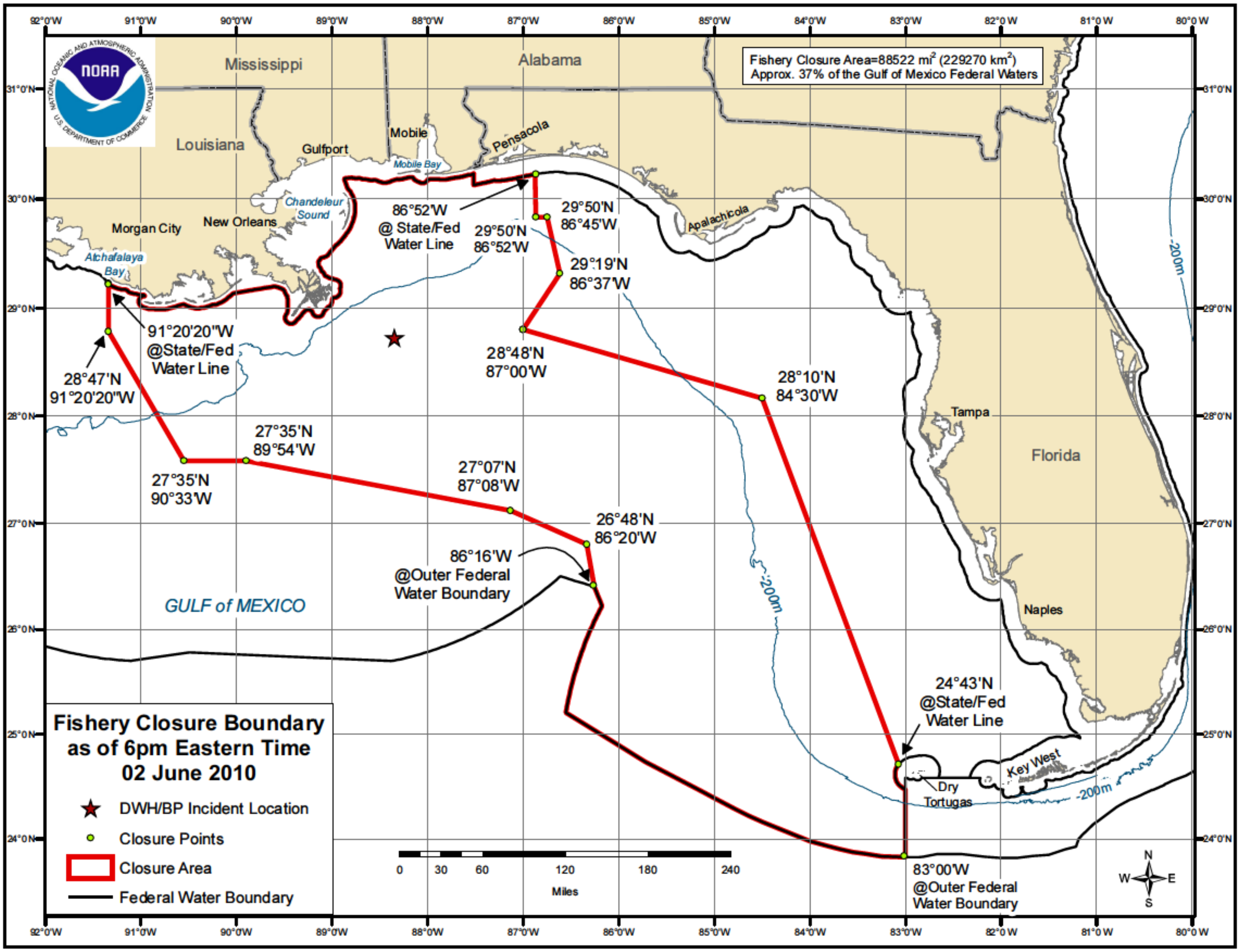

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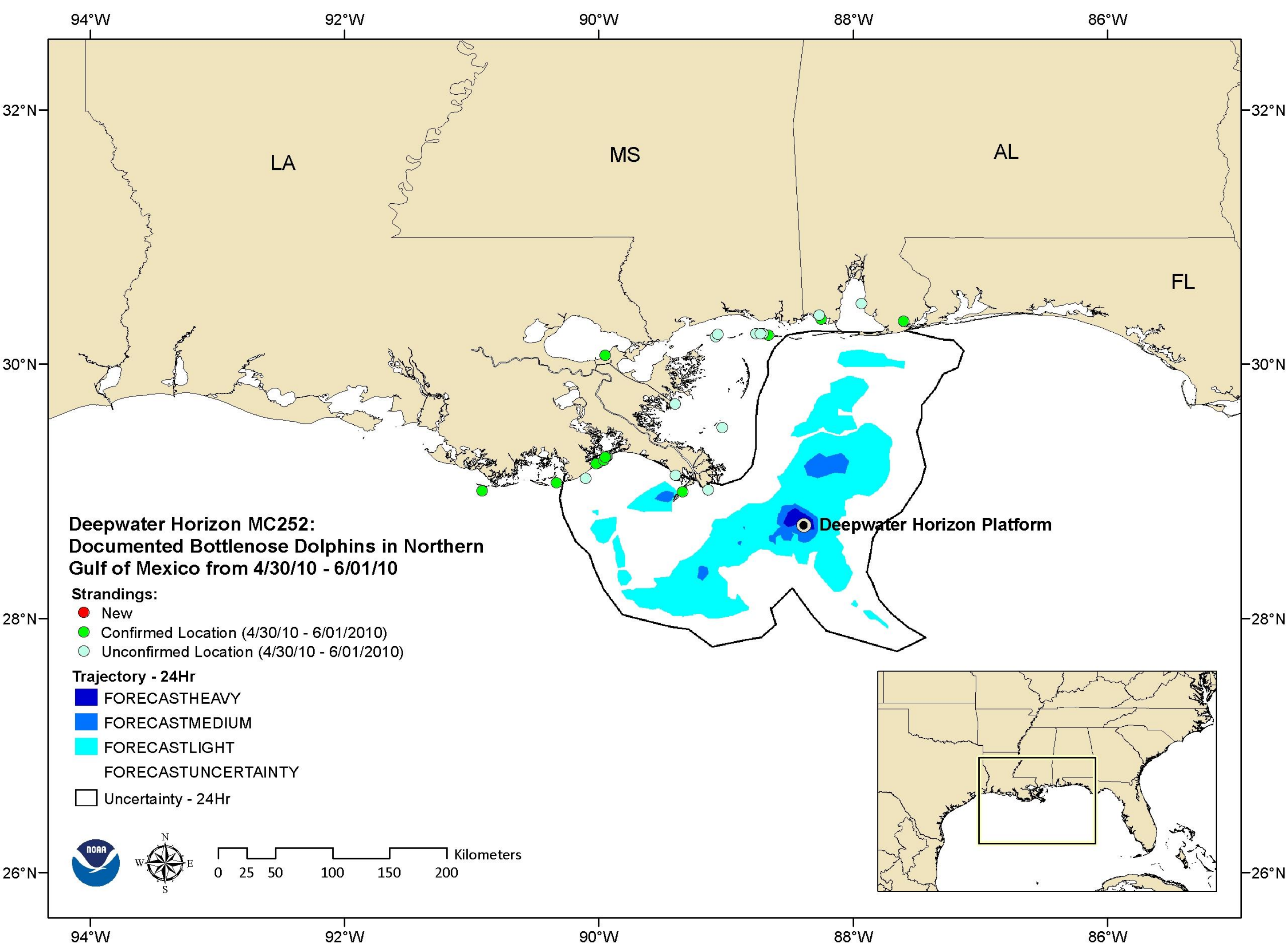

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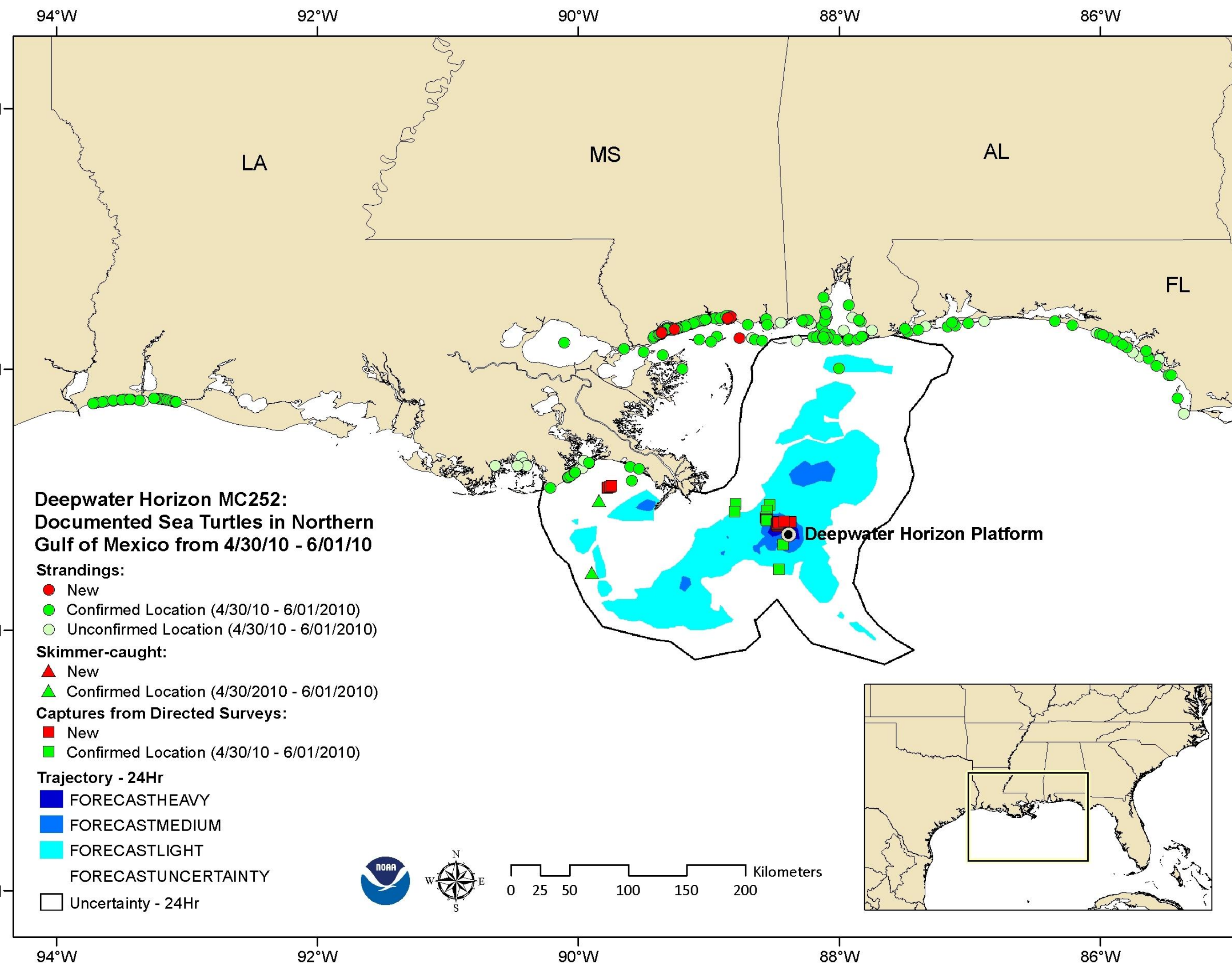

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Update through 1 June 2010 (as of 1800)

Marine Mammal and Sea Turtle Health and Response

Noteworthy Developments During this Reporting Period:

- Increase of 10 turtle strandings (all in MS)
- Decrease of 1 turtle stranding in FL, removal of duplicate record
- Increase of 14 live turtles captured during directed turtle search efforts
- Increase of 1 dead turtle captured during directed turtle search efforts
- It is becoming increasingly apparent, based on our on-water observations and enhanced understanding of cleanup operations (i.e., skimmer vessels and surface burns) that sea turtles are being significantly impacted including substantial takes. For example, the material that is being targeted by at least some of the in situ burn operations is the same surface material (rafts of *Sargassum*, oil, weathered oil, and mousse) that we are searching and recovering live, oiled turtles in.
- Increase of 1 previously stranded dolphin fully necropsied; no visible external or internal oil was observed

Sea Turtles:
277 total sea turtles verified to date within the "designated spill area" (increase of 24 from 1800 June 1)

- 252 stranded (increase of 9 from 1800 June 1)
  - 232 of the stranded were found dead (increase of 4 from 1800 June 1)
  - 20 of the stranded were found alive (increase of 5from 1800 June 1)
    - 3 recovered alive but died in rehab (no change from 1800 June 1)
    - 1 turtle released alive (no change from 1800 June 1)
    - 16 live turtles in rehabilitation (increase of 5 from 1800 June 1)

- 25 turtles collected during directed turtle sampling efforts (increase of 15from 1800 June 1)
  - 24 live turtles in rehabilitation (increase of 14 from 1800 June 1)
  - 1 turtle collected dead (increase of 1 from 1800 June 1)

* For this event, a true stranding is defined as a turtle that washes ashore dead or debilitated or is found floating dead or debilitated in the course of non-directed turtle surveys. Turtles observed and/or captured during directed sampling efforts are not categorized as strandings.

Turtle Necropsy Status (of the 232 dead stranded, 1 dead directed capture, and 3 that died in rehab):

- 7 assessed and unable to perform necropsies (i.e. advance decomposition) (no change from 1800 June 1)
- 17 partial necropsies (e.g. due to scavenging or autolysis) (no change from 1800 June 1)
- 50 full necropsies performed (no change from 1800 June 1)
- 44 carcasses not collected due to decomposition state or unable to recover but marked and/or buried (no change from 1800 June 1)
- 118 carcasses to be necropsied, if decomposition stage warrants (increase of 4 from 1800 June 1)

- Of the 67 full or partial necropsies completed, the two primary considerations for the cause of these strandings are forced submergence or acute toxicosis.

Information on Signs of Oiling:
- To date, visible evidence of oil has been documented externally on 1 dead stranded sea turtle, and 2 live stranded sea turtles caught in skimming operations.
- To date, visible evidence of oil has been documented externally on 24 live sea turtles and one dead sea turtle captured during directed turtle surveys.

Historical Strandings:
- The total number of sea turtle strandings that we have documented from the Louisiana/Texas border through the Florida panhandle from April 30th through 1800 June 1st is 252.
- This is much higher than the number of turtle strandings that have been documented in recent years in Louisiana, Mississippi, and Alabama during this time frame (combined range of 4-30 for LA, MS, and AL)
    - Overall Northern Gulf range for recent years has been 18-46.
    - From 2005 – 2009 the number of turtle strandings for the month of May has ranged from 1 to 15 in Louisiana
    - From 2005 – 2009 0 to 13 in Mississippi
    - From 2005 – 2009 1 to 15 in Alabama.
    - In the Florida panhandle, from 2003 – 2007, the number of strandings in May has ranged from 13 to 37
- There has been an increase in awareness and human presence in the northern Gulf of Mexico, which likely has resulted in some of the increased documentation of stranded turtles; however, we do not believe this factor fully explains the increase.

Marine Mammals:
- 29 dolphins have been verified to date within the "designated spill area" (no change from 1800 June 1).
    - All 29 were dead stranded dolphins (no change from 1800 June 1)

* Under the Marine Mammal Protection Act Section 409.3, a marine mammal stranding is defined as an event in the wild where:
- A marine mammal is dead and is on the beach or shore of the United States or in waters under the jurisdiction of the United States (including any navigable waters); OR
- A marine mammal is alive and is on a beach or shore of the United States and unable to return to the water, on a beach or shore of the United States and, although able to return to the water, is an apparent need of medical attention or in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance.

Dolphin Necropsy Status:
- 12 assessed and unable to perform necropsies (e.g. advanced decomposition) (no change from 1800 June 1)

- 7 partial necropsies performed (e.g. due to scavenging or autolysis) (no change from 1800 June 1)
- 4 full necropsies performed (increase of 1 from 1800 June 1)
- 6 Verified strandings but animals not collected due to stage of decomposition or unable to recover (no change from 1800 June 1)
- 0 Carcasses to be necropsied, if decomposition stage warrants (decrease of 1 from 1800 June 1; animal necropsied on June 1)

Information on Signs of Oiling:

- One of the dolphins had evidence of external oil on its tongue and body and therefore is classified as oiled. Since the carcass was first reported in the water/oil line on the oiled beach, we are unable at this time to determine whether the animal was externally covered in oil post mortem when the carcass came on shore or was oiled prior to death.

Historical Strandings

- Since April 30th, the stranding rate of dolphins in Louisiana is higher than the historic numbers, but in part, this may be a reflection of increased detection and reporting and the lingering effects of an earlier observed spike in strandings for the winter of 2010.

- During this time frame, this is higher than the number of dolphin strandings that have been documented in recent years (2003-2007) in Louisiana, Mississippi, and Alabama and the combined range of 0-10 for LA, MS, and AL. For the entire Northern Gulf of Mexico, the combined range is 0-14 for the years 2003 to 2007 in LA, MS, AL, FL (Panhandle). The breakdown by state for the range of animals historically stranding in the month of May (2003-2007) is as follows:
  - Louisiana: 0-4 stranded dolphins
  - Mississippi: 0-3 stranded dolphins
  - Alabama : 0-3 stranded dolphins
  - Florida panhandle: 0-4 stranded dolphins

Summary of Action Plan Items:

- The on –water directed survey for turtles under Unified Command continued on June 1st. Ten turtles (8 Kemp's ridleys, 1 loggerhead, 1 hawksbill) were captured working approximately 40 miles offshore. All turtles were pelagic stage juveniles, alive and very oiled, their behavior was abnormal, but they were still responsive. All were initially cleaned on the support vessel and received initial veterinary care. They were transported to Audubon Aquarium and are undergoing further care.
- A Louisiana DWF enforcement vessel went offshore Grand Isle to look for turtles and collected 4 live and 1 dead Kemp's ridley, all oiled. This operation was not coordinated through Unified Command and we are working to resolve communication and coordination issues as well as de-oiling facility logistics and staffing. It is unclear whether LDWF intends to continue, enhance, or decrease this effort in the coming days.
- Skimmer vessels, especially a few newly added vessel specifically deployed to suck up oiled *Sargassum* mats, are of significant concern as far as clean up operations go. An SEC staff member observed a prototype barge skimmer off the AL/MS coast on June 1st

and is providing a report. We continue to work to deploy observers and navigate the BP contracting path for these observers. The Houma and Mobile ICCs are working together to identify the best use of observers.

- Another report was received of dolphins strand feeding near Grand Isle (a normal behavior that is commonly confused with animals being in distress). We have developed an information sheet for distribution to the public and media, and are working with the JIC to get that released.

SCIENCE IN SUPPORT OF DEEPWATER HORIZON OIL SPILL RESPONSE

NOAA

http://response.restoration.noaa.gov
http://www.aoml.noaa.gov/phod/dhos/index.php

Introduction

Authorities for NOAA's role:

- Scientific support to U.S. Coast Guard (USCG) under the Oil Pollution Act of 1990 (OPA-90): NOAA provides scientific support to USCG in their role as Federal On-Scene Coordinator (FOSC) for Oil Spill Response Actions
- Seafood Safety Management under Magnuson-Stevens Fishery Conservation and Management Act (MSRA).
- Living Marine Resource protection under MSRA, Marine Mammal Protection Act (MMPA), and Endangered Species Act (ESA) as well as other statutes such as the Fish and Wildlife Coordination Act. Marine Health and Stranding Response Act
- Natural Resource Damage Assessment under OPA-90: NOAA, as a Trustee for natural resources, works with other federal and state trustees to assess the injuries to natural resources from the oil spill and the oil spill response actions.
- Oceans and human health effects, including effects on ecosystem health, marine organism health, and human health under Oceans and Human Health Act, Harmful Algal Blooms and Hypoxia Research and Control Act.

Immediate Actions (event to 2 months)

NOAA is providing scientific support to the Response Incident Command, through the USCG FOSC. This includes daily trajectories for fate and transport of surface oil, higher resolution of the interaction between surface oil and the Loop Current, daily predictions of shoreline oil impacts, on-scene assessment of shoreline oiling through overflights and Shoreline Cleanup and Assessment Technology Technique (SCAT) models describing likely fate and transport of oil dispersed at the well head, daily observations and evaluations of marine mammal and turtles, estimates of oil flow rates, organization of scientific data, and ongoing science briefs to local, state, and national groups. NOAA currently staffs command posts in Robert LA, Houma LA, Venice LA, Mobile AL, St. Petersburg FL, Miami FL, and Key West FL. NOAA also has a scientific support group in Seattle WA and provides staff for the National Incident Command in Washington, DC. As of the end of May, NOAA has four aircraft, two NOAA ships, and is supporting/has supported five contract ships involved in this incident. Additionally, through partnerships, NOAA is supporting several additional cruises and is working closely with non-federal as well as federal partners in coordinating information derived from a fleet of AUVs and gliders operating throughout the northeastern Gulf of Mexico.

NOAA is closing federal waters to fishing based on oil trajectories, initiating training for seafood safety assessment for oil and dispersant contamination - via both organoleptic and chemical analyses - and collecting untainted seafood for these tests and trainings. As a Trustee for natural resources, NOAA is working with USFWS, NPS, DoD, LA, MS, AL, FL, and TX to collect samples of both baseline and impacted resources. To date, over 2000 were collected.

A summary of past and on-going NOAA immediate response actions include:

- Scientific support to the Incident Command through the USCG FOSC;
- Collecting a broad suite of Mussel Watch and other samples for determination of baseline environmental conditions immediately prior to coastal/shoreline contamination by the DWH oil;
- Assessing the safety of seafood and inform appropriate closures of federal waters;
- Evaluating dispersant and oil related to seafood safety – conduct baseline contaminant studies and include post-Katrina data;
- Calculating oil flow from the DWH site to estimate total release of oil;
- Tracking surface oil and dispersant fate and transport;
- Measuring distribution and magnitude of subsurface dispersed oil and dispersant through acoustics, fluorescence studies, water sampling, and other technologies with NOAA Research Vessels and partners, Participate in interagency Joint Analysis Group (JAG);
- Measuring impact of subsea dispersed oil on hypoxia events;
- Conducting aerial surveys of protected species distribution and abundance;
- Updating state of the Loop Current hydrodynamics – aircraft deployed ocean profilers and oceanographic cruises;
- Conducting baseline studies of natural resources (water, sediment, biota, human use);
- Developing and conducting studies to measure injuries of trust resources (water, sediment, biota, human use) by oil and or response actions; and,
- Initializing studies on effects of dispersants on marine organisms

Near-Term Actions

Assuming oil continues to flow from the well head through August, many of the near-term actions will look similar to the immediate actions. Some longer-term NOAA studies may be developed and undertaken, such as those designed to demonstrate and quantify oceanographic observations and modeling to predict trajectories, injury to natural resources, continued testing of seafood for fishery closure and seafood safety considerations, and studies to gain higher resolution on extent and fate of subsea dispersed oil. Restoration planning will likely commence.

- Continued scientific support to the IC through USCG FOSC (including trajectory predictions, Loop Current evaluation, predicted shore line impacts, etc.).
- Mass balance calculations to understand surface and sub-surface fractions of total release

- Continued assessment of shoreline oil impacts and support for scientifically appropriate clean-up actions.
- Continued surveys to assess the magnitude, characteristics, fate, transport and near-term effects of subsurface dispersed oil
- Surveys of potential oil and dispersants in seafood species in closed and open areas
- Identification and initiation of studies to quantify natural resource injuries.
- Additional human dimensions studies to understand the impact of the event on coastal community, including outreach efforts by Sea Grant
- Exploring novel mechanisms for engaging the broader scientific community

Long-Term Actions (2 months-decadal)

Long-term impacts of the spill are likely ecosystem-wide, with particular relevance to various habitat types from salt marshes to deep coral/biogenic communities to human communities. Studies are needed to establish baselines, which are essential to determine the extent of natural resource damages. These studies and baselines include:

- Natural Resource Damage Assessment injury studies;
- Long-term studies of impacted areas, salt marsh productivity, species composition, and geochemistry;
- Ecosystem level restoration needs and opportunities along the northern GOM;
- Long-term assessment of surface ocean productivity (e.g., following the long-term impact(s) to neuston) including ecosystem-wide impacts;
- Long-term impacts to deep communities (e.g., deep water corals);
- Long-term connections between dispersed oil and GOMEX hypoxia events;
- Planning for and initiation of long-term ecosystem and socio-economic impact studies;
- Effects of oil, dispersants, and dispersant-oil mixtures at the surface, sub-surface and atmosphere on LMR and ecosystem processes, productivity, and services; and,
- Effects on key habitats and natural biodiversity, with special emphasis on coastal wetlands and estuarine nursery areas.

Science Summary Related to the DWH-MC-252 OIL SPILL

NOAA

June 3, 2010

Dr. Jane Lubchenco, Administrator

Immediate Science Actions (First 2 months)

- Scientific support to the IC through the USCG FSOC
- Collection of a broad suite of samples to assess baseline environmental conditions
- Assess the Safety of Seafood and inform appropriate closures of federal waters
- Evaluate dispersant and oil related to seafood safety – conduct baseline contaminant studies
- Assist to calculate oil flow from the DWH site to estimate total release of oil
- Track surface oil and dispersant fate and transport
- Initial studies on effects of dispersants on marine organisms
- Initiate and participate in interagency Joint Analysis Group (JAG)
- Measure impact of subsea dispersed oil on hypoxia events
- Measure distribution and magnitude of subsurface dispersed oil and dispersant through acoustics, fluorescence studies, water sampling and other technologies using NOAA Research Vessels and partners, including IOOS
- Conduct aerial surveys of protected species distribution and abundance
- Update increased sensitivity of the Loop Current hydrodynamics – P-3s dropping AXBTs, sponsoring oceanographic cruises
- Conduct baseline studies of natural resources (water, sediment, biota, human use)
- Develop/Conduct studies to measure injuries of trust resources (water, sediment, biota, human use) by oil and or response actions
- Daily-weekly weather forecasts critical for field operations

Daily Surface Oil Forecasts

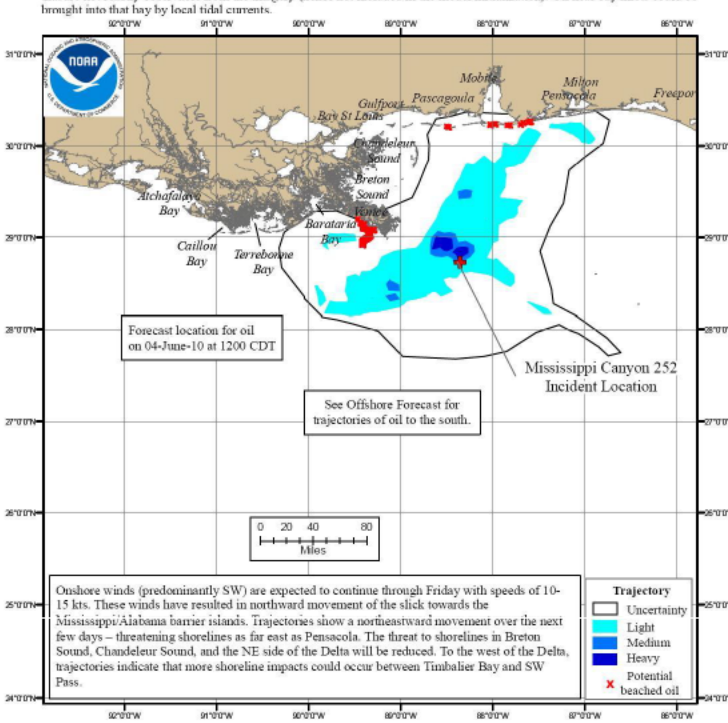
Nearshore Surface Oil Forecast Deepwater Horizon MC252

NOAA/NOS/OR&R

Nearshore

Estimate for: 1200 CDT, Friday, 6/04/10
Date Prepared: 2100 CDT, Tuesday, 6/01/10

This forecast is based on the NWS spot forecast from Tuesday, June 1 PM. Currents were obtained from several models (NOAA Gulf of Mexico, West Florida Shelf/USF, NAVO/NRL) and HFR measurements. The model was initialized from Tuesday satellite imagery analysis (NOAA/NESDIS) and overflight observations. The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization). Oil near bay inlets could be brought into that bay by local tidal currents.



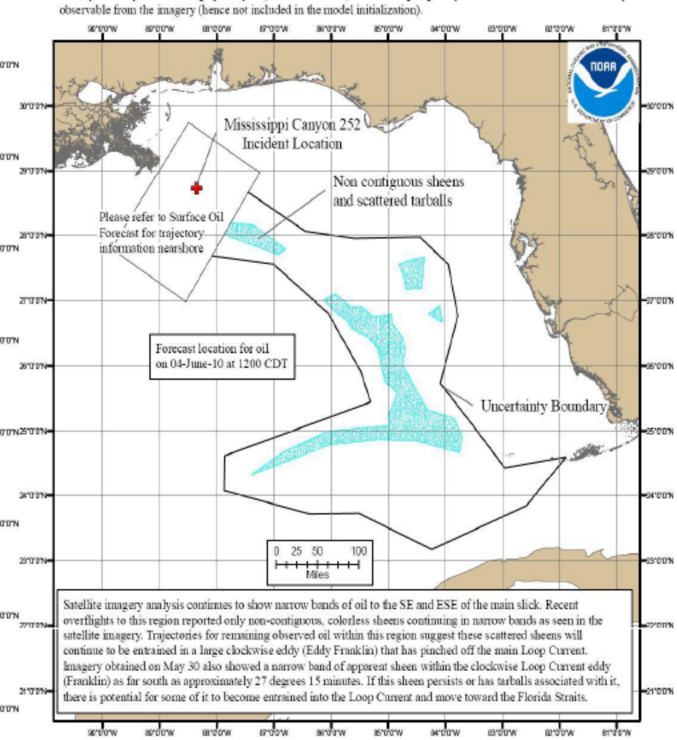
Offshore Surface Oil Forecast Deepwater Horizon MC252

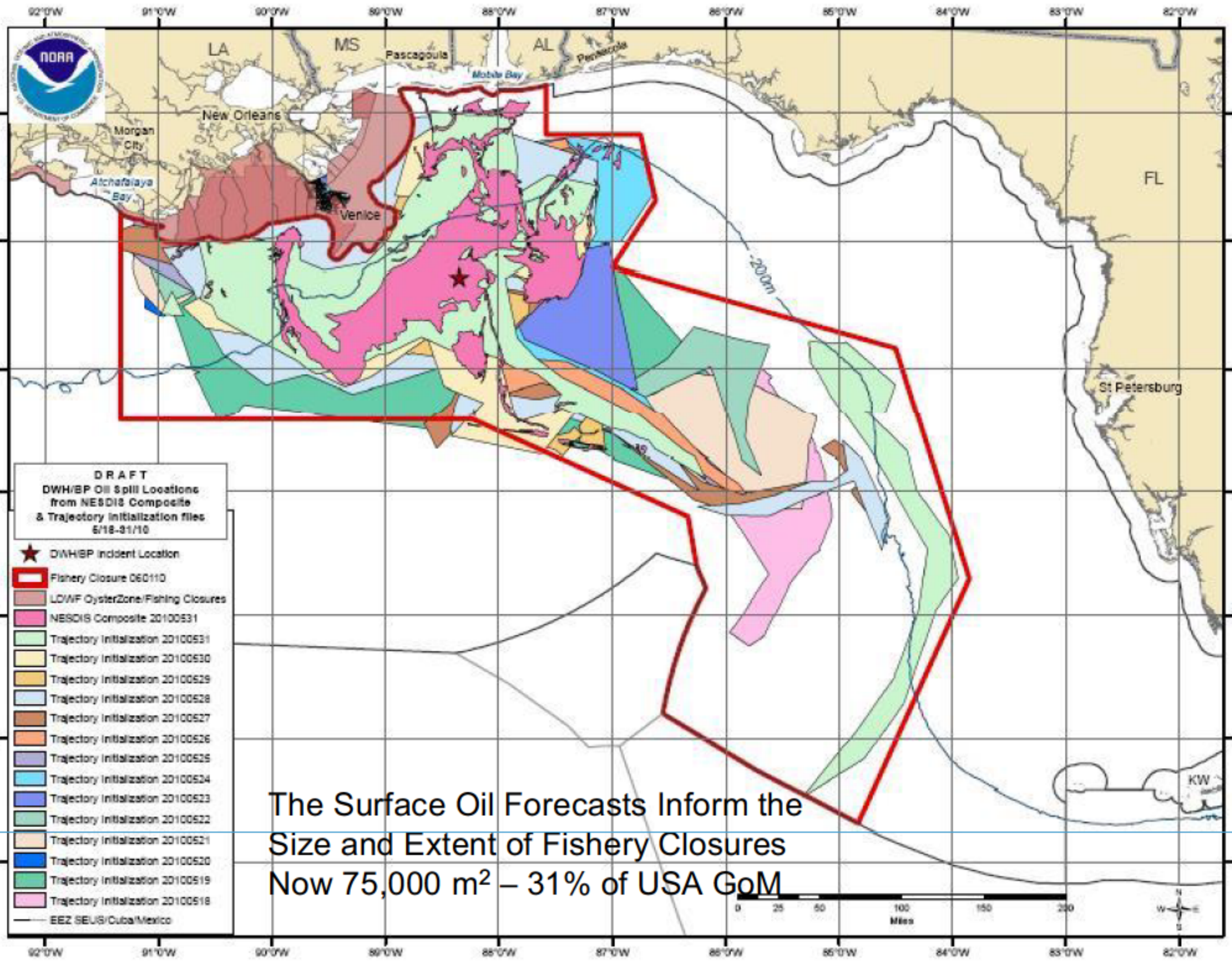
NOAA/NOS/OR&R

Offshore

Estimate for: 1200 CDT, Friday, 6/04/10
Date Prepared: 1900 CDT, Tuesday, 6/01/10

Currents were obtained from three models: NOAA Gulf of Mexico, NavO/NCOM, and NRL/IASNFS. Each includes Loop Current dynamics. Gulf wide winds were obtained from the gridded NCEP product. The model was initialized from Sunday-Tuesday satellite imagery analysis (NOAA/NESDIS). The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization).





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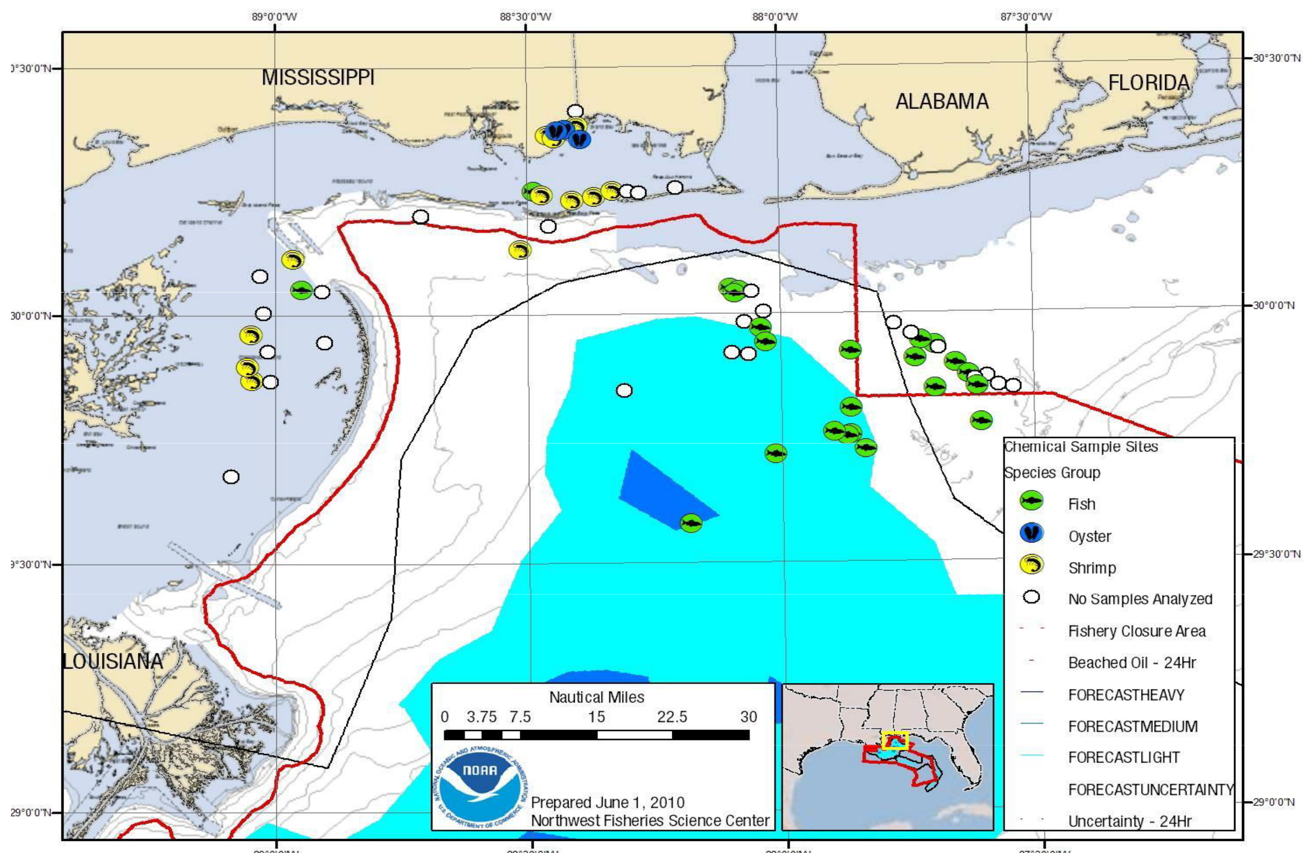
Seafood Safety Baselines collected for Snappers, groupers, shrimp and Oysters in LA, MS, AL, extending baselines to FL & TX
Baseline samples all well below the action levels (1/10 or below)



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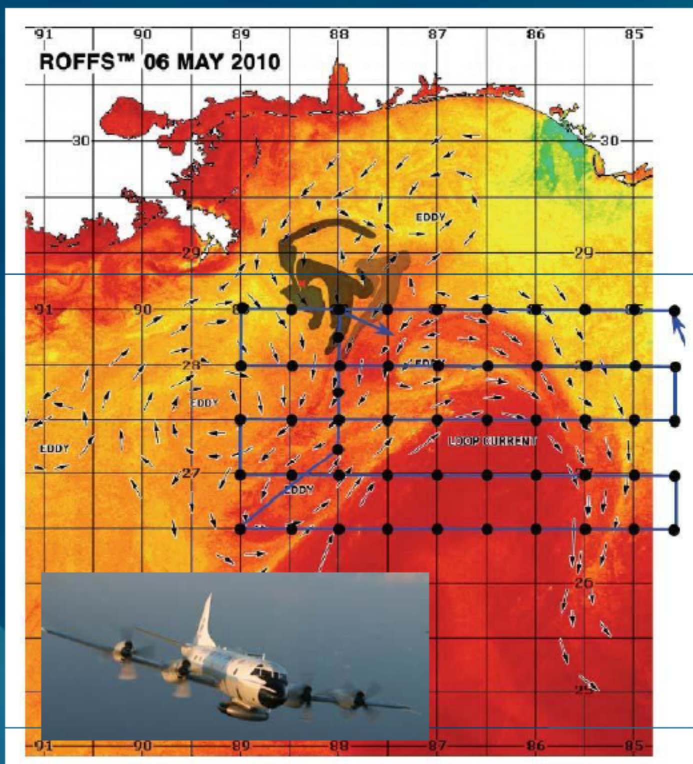
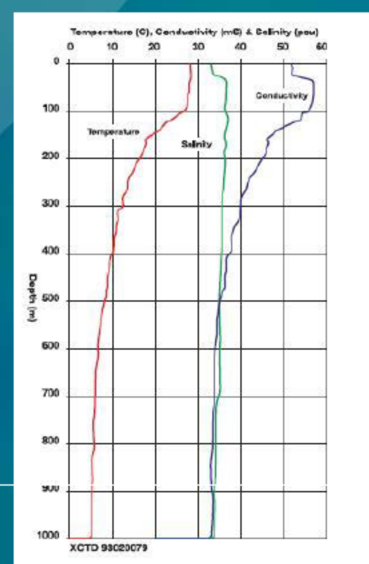


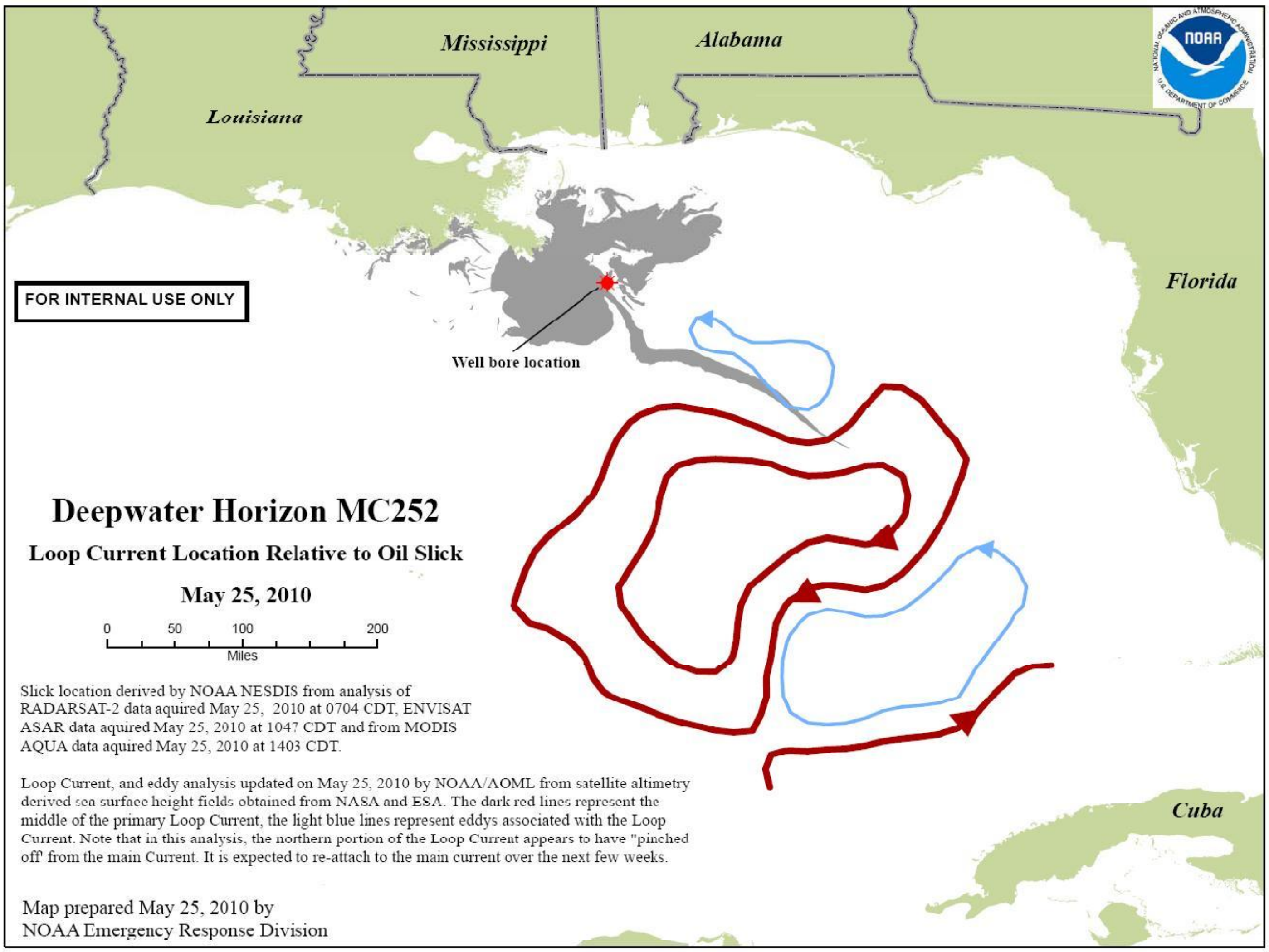
• NOAA WP-3D aircraft deployed airborne expendable current and conductivity with depth probes (AXCP and AXCTD, respectively) to provide deep-water (~1000m) profiles of currents and salinity in the vicinity of the oil spill and the Loop Current. Focus on area between oil & LC on 4 occasions



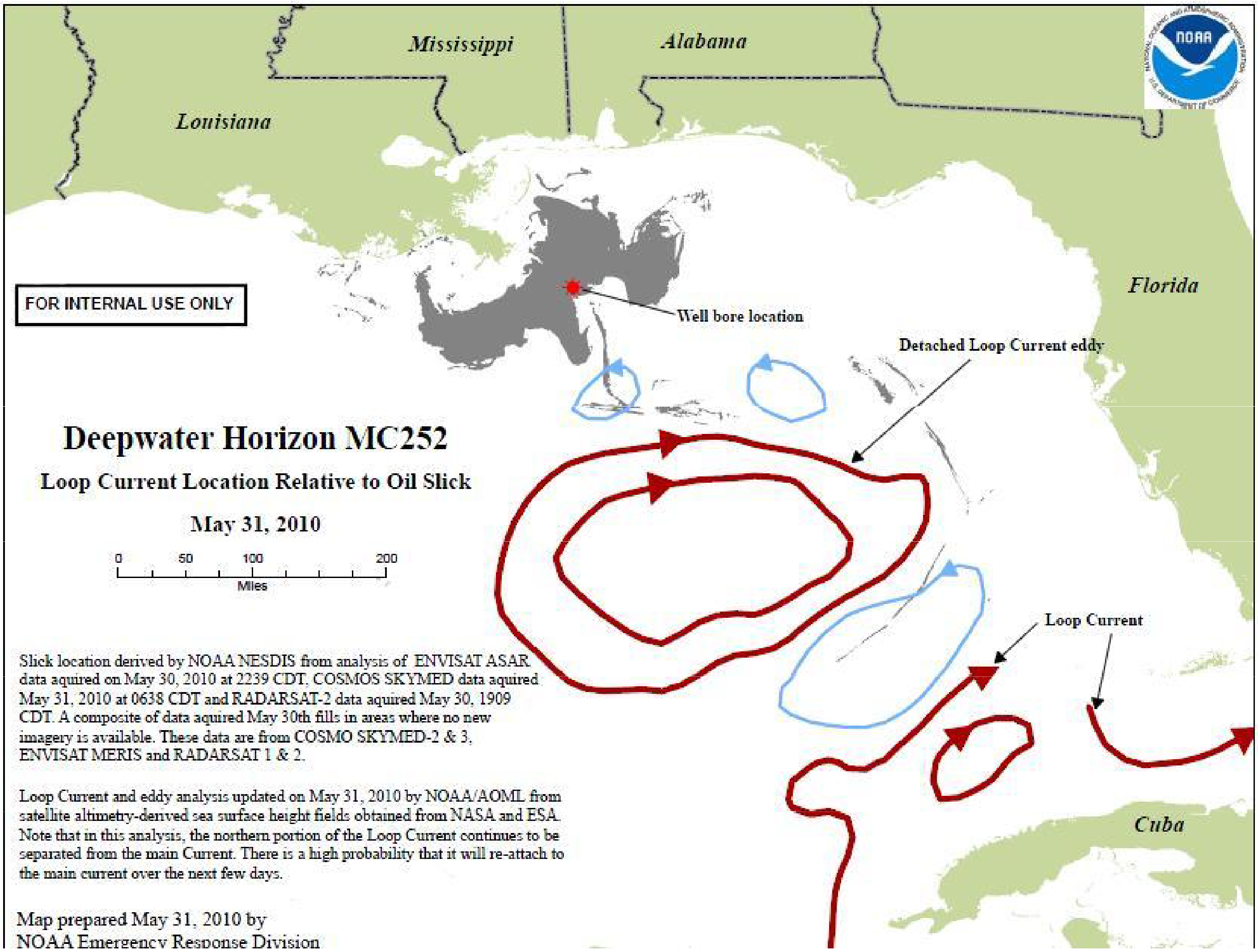
An AXCTD profile

PROBE SPECIFICATIONS

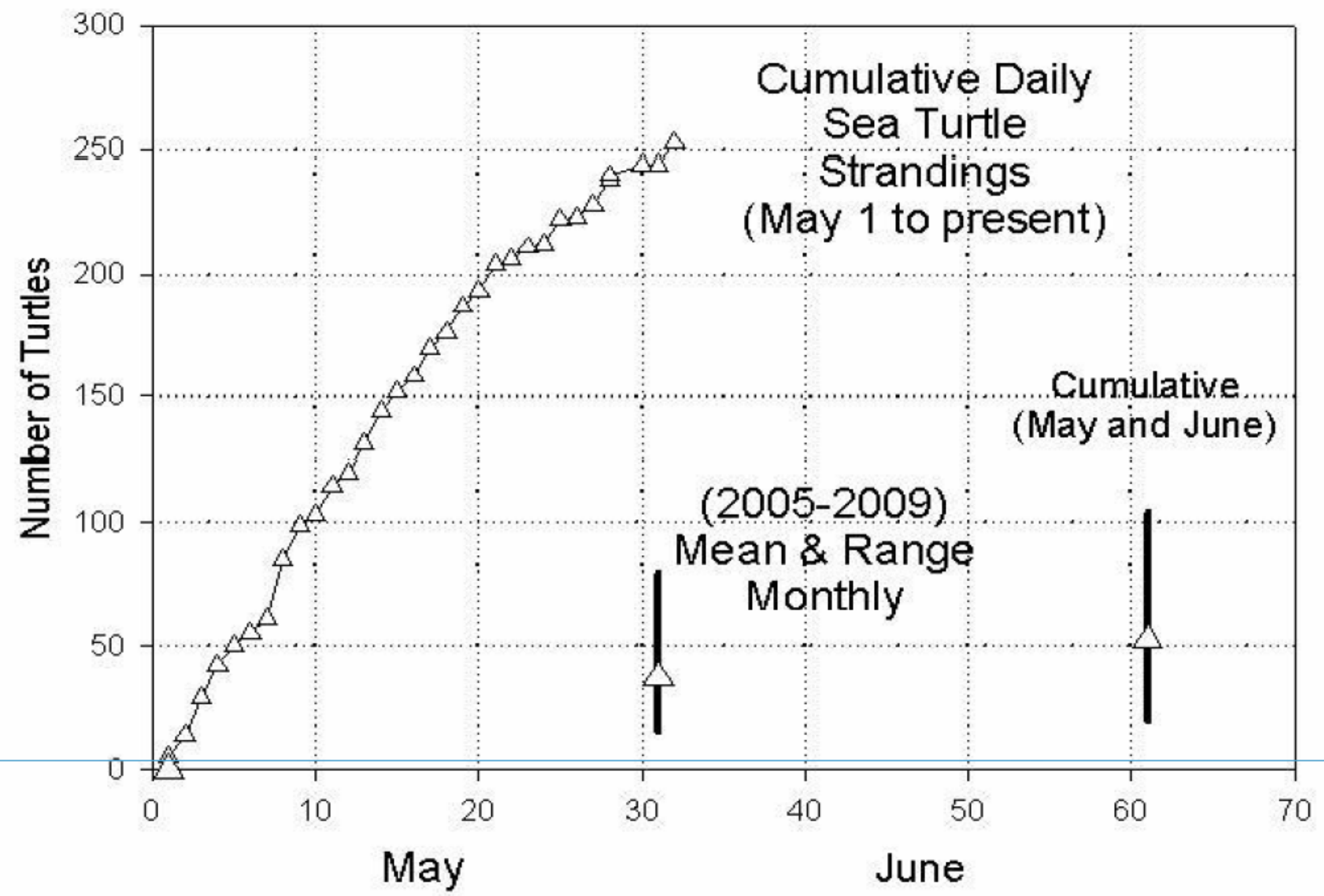
PROBE	PARAMETER	DEPTH	ACCURACY	ACQUISITION SYSTEM
AXCTD	conductivity, temperature	1000 m	-0.035 mS/cm, -0.035°C	MK 12
AXSV	sound velocity	850 m	-0.025 m/sec	MK 12
AXCP	current velocity, temperature	1500 m	-1.0 cm/sec RMS, -0.2 °C	MK 10

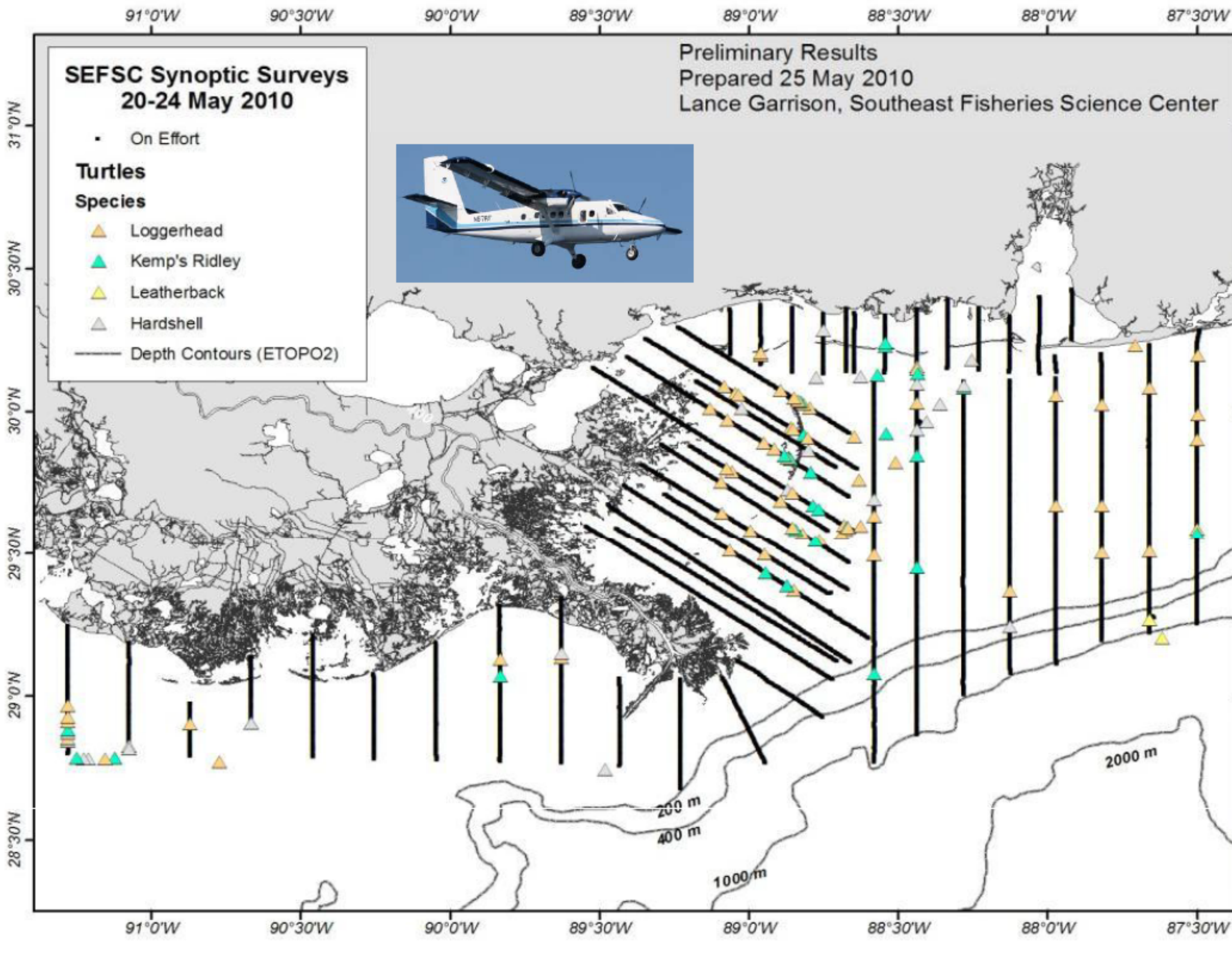


Mississippi
Alabama
Louisiana
Florida
Cuba
FOR INTERNAL USE ONLY
Well bore location
Deepwater Horizon MC252
Loop Current Location Relative to Oil Slick
May 25, 2010
0
50
100
200
Miles
Slick location derived by NOAA NESDIS from analysis of RADARSAT-2 data aquired May 25, 2010 at 0704 CDT, ENVISAT ASAR data aquired May 25, 2010 at 1047 CDT and from MODIS AQUA data aquired May 25, 2010 at 1403 CDT.
Loop Current, and eddy analysis updated on May 25, 2010 by NOAA/AOML from satellite altimetry derived sea surface height fields obtained from NASA and ESA. The dark red lines represent the middle of the primary Loop Current, the light blue lines represent eddys associated with the Loop Current. Note that in this analysis, the northern portion of the Loop Current appears to have "pinched off" from the main Current. It is expected to re-attach to the main current over the next few weeks.
Map prepared May 25, 2010 by
NOAA Emergency Response Division

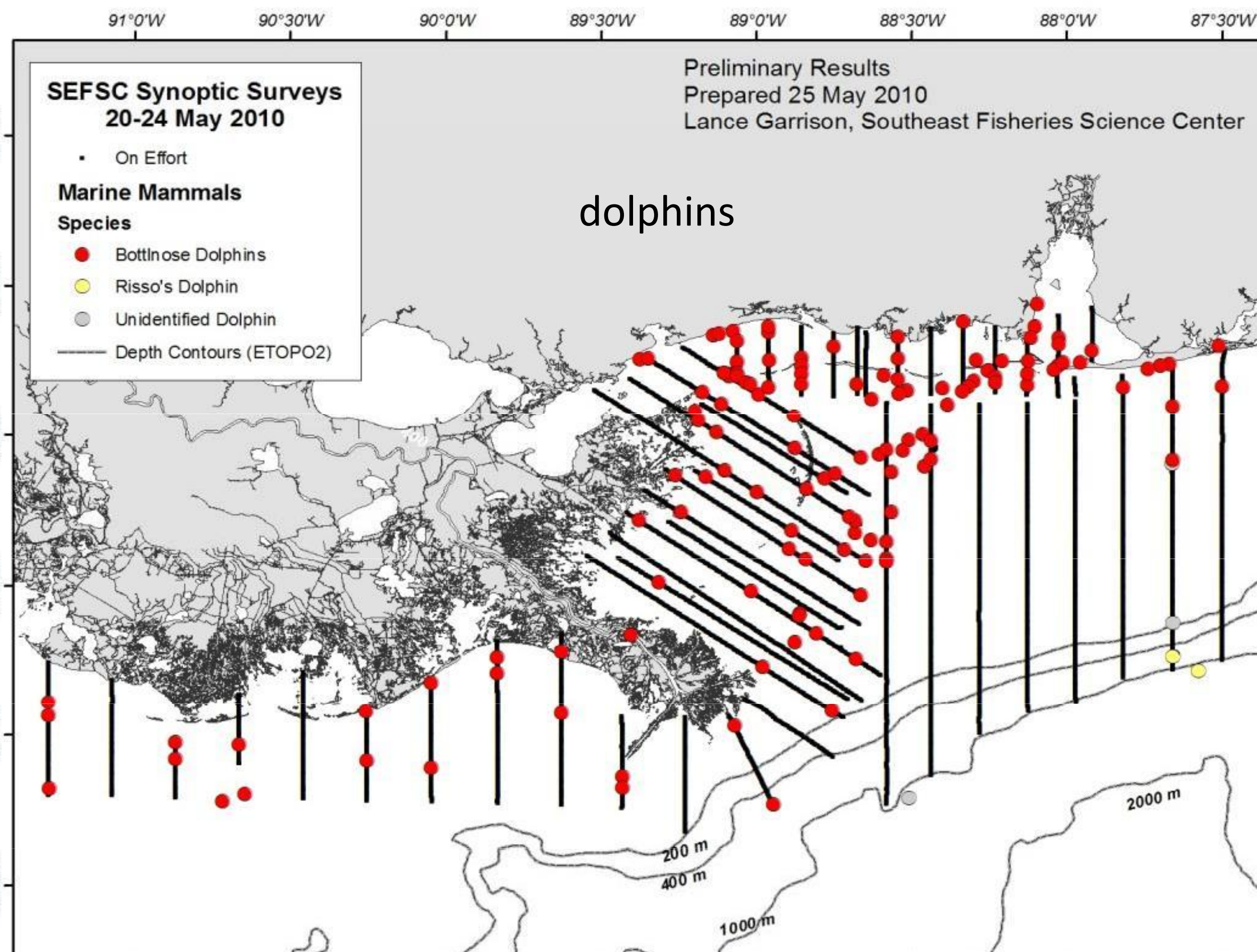

Mississippi
Alabama
Louisiana
Florida
Cuba
FOR INTERNAL USE ONLY
Well bore location
Detached Loop Current eddy
Loop Current
Deepwater Horizon MC252
Loop Current Location Relative to Oil Slick
May 31, 2010
0 50 100 200
Miles
Slick location derived by NOAA NESDIS from analysis of ENVISAT ASAR data aquired on May 30, 2010 at 2239 CDT. COSMOS SKYMED data aquired May 31, 2010 at 0638 CDT and RADARSAT-2 data aquired May 30, 1909 CDT. A composite of data aquired May 30th fills in areas where no new imagery is available. These data are from COSMO SKYMED-2 & 3, ENVISAT MERIS and RADARSAT 1 & 2.
Loop Current and eddy analysis updated on May 31, 2010 by NOAA/AOML from satellite altimetry-derived sea surface height fields obtained from NASA and ESA. Note that in this analysis, the northern portion of the Loop Current continues to be separated from the main Current. There is a high probability that it will re-attach to the main current over the next few days.
Map prepared May 31, 2010 by
NOAA Emergency Response Division

Protected Resources a Major Concern





SEFSC Synoptic Surveys
20-24 May 2010
On Effort
Turtles
Species
Loggerhead
Kemp's Ridley
Leatherback
Hardshell
Depth Contours (ETOPO2)
Preliminary Results
Prepared 25 May 2010
Lance Garrison, Southeast Fisheries Science Center
91°0'W
90°30'W
90°0'W
89°30'W
89°0'W
88°30'W
88°0'W
87°30'W
31°0'N
30°30'N
30°0'N
29°30'N
29°0'N
28°30'N
200 m
400 m
1000 m
2000 m

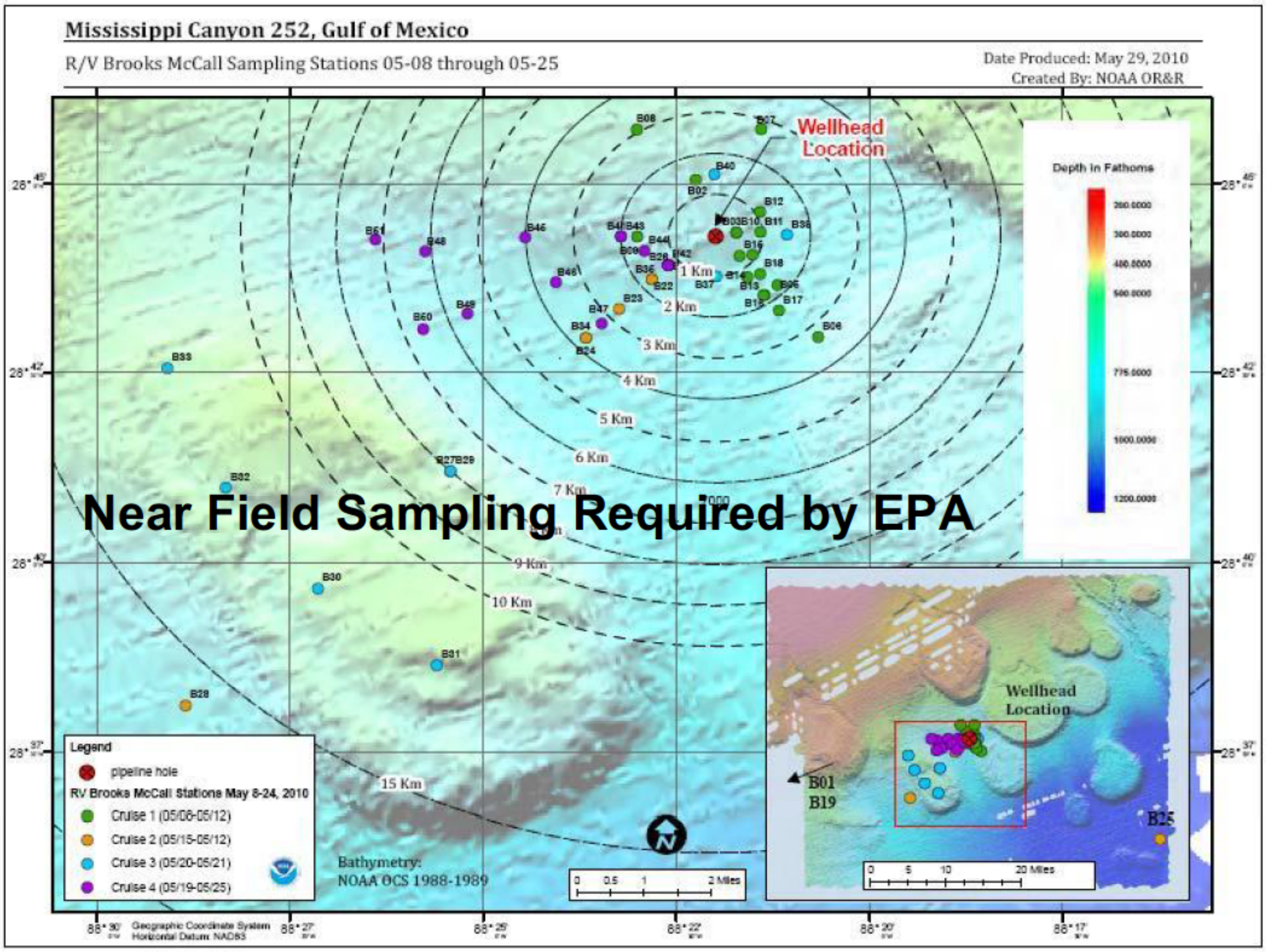


SEFSC Synoptic Surveys
20-24 May 2010
On Effort
Marine Mammals
Species
Bottlnose Dolphins
Risso's Dolphin
Unidentified Dolphin
Depth Contours (ETOPO2)
Preliminary Results
Prepared 25 May 2010
Lance Garrison, Southeast Fisheries Science Center
dolphins
91°0'W
90°30'W
90°0'W
89°30'W
89°0'W
88°30'W
88°0'W
87°30'W
31°0'N
30°30'N
30°0'N
29°30'N
29°0'N
28°30'N
200 m
400 m
1000 m
2000 m

Sub-Surface Sampling for Oil and Dispersants

- Required Near-Field sampling for sub-surface dispersant application
- NOAA Research Vessels and NOAA Sponsored Cruises
- Other sampling Efforts Sponsored by Others

At lease 7 research vessels involved in collecting data using a variety of technologies including ship-board acoustics, flurometry, water sampling using CTD, water sampling with AUV, neuston, Mocness, and trawling, sediment samples



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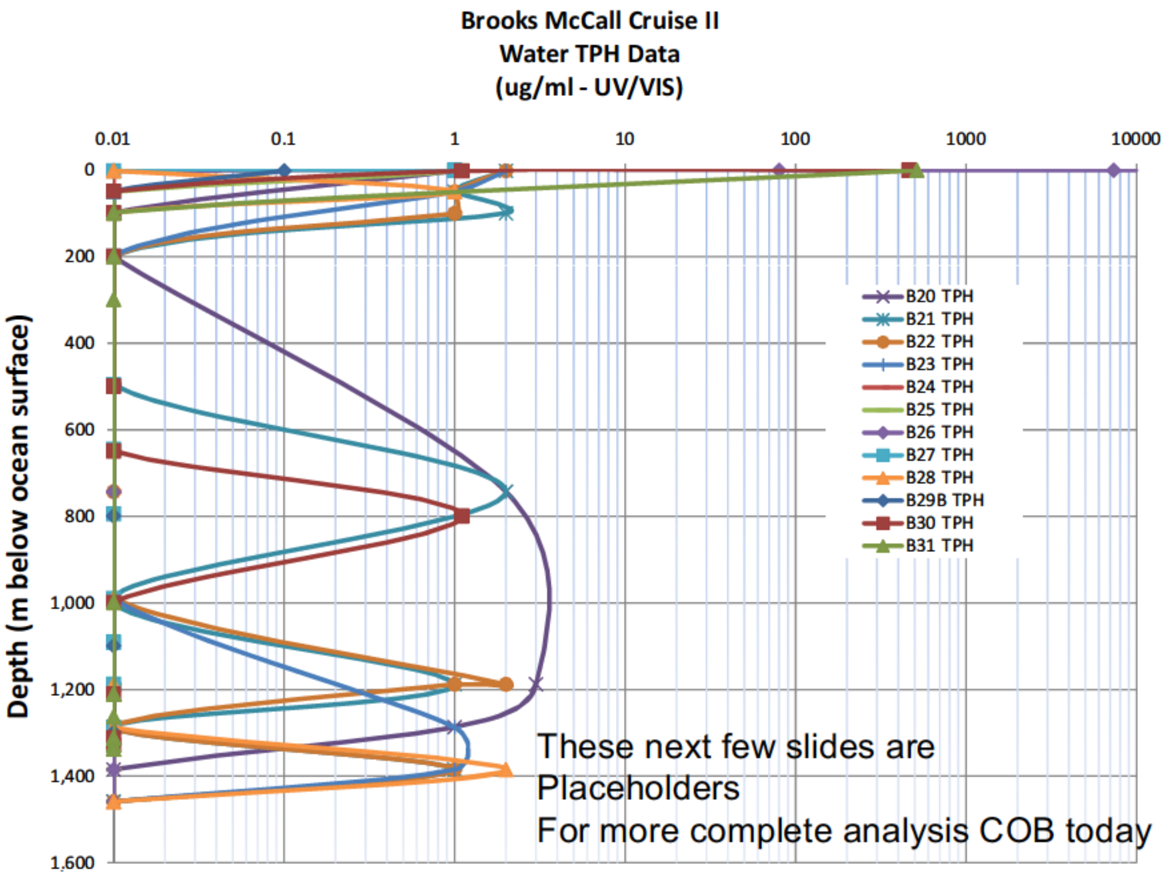
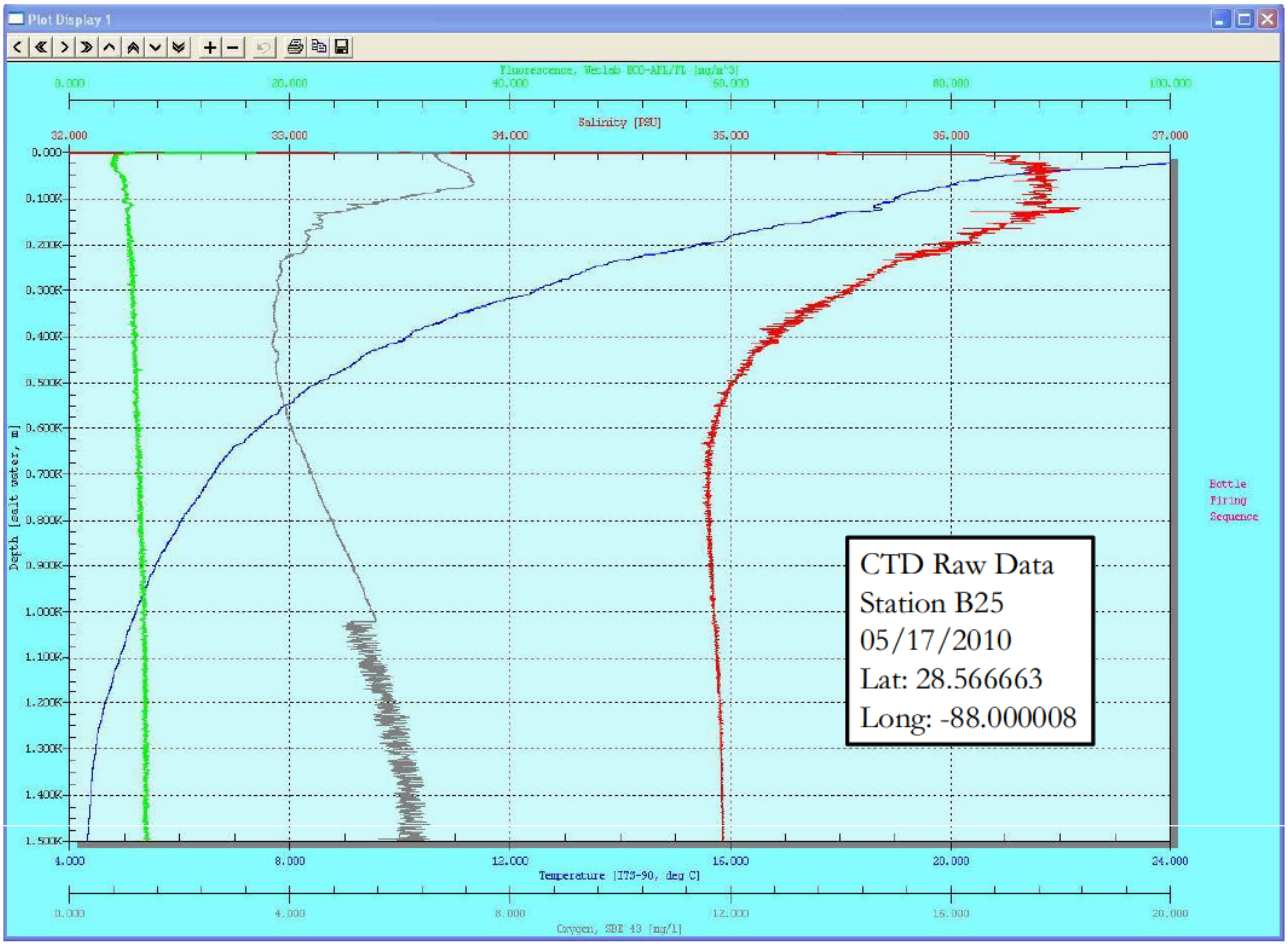
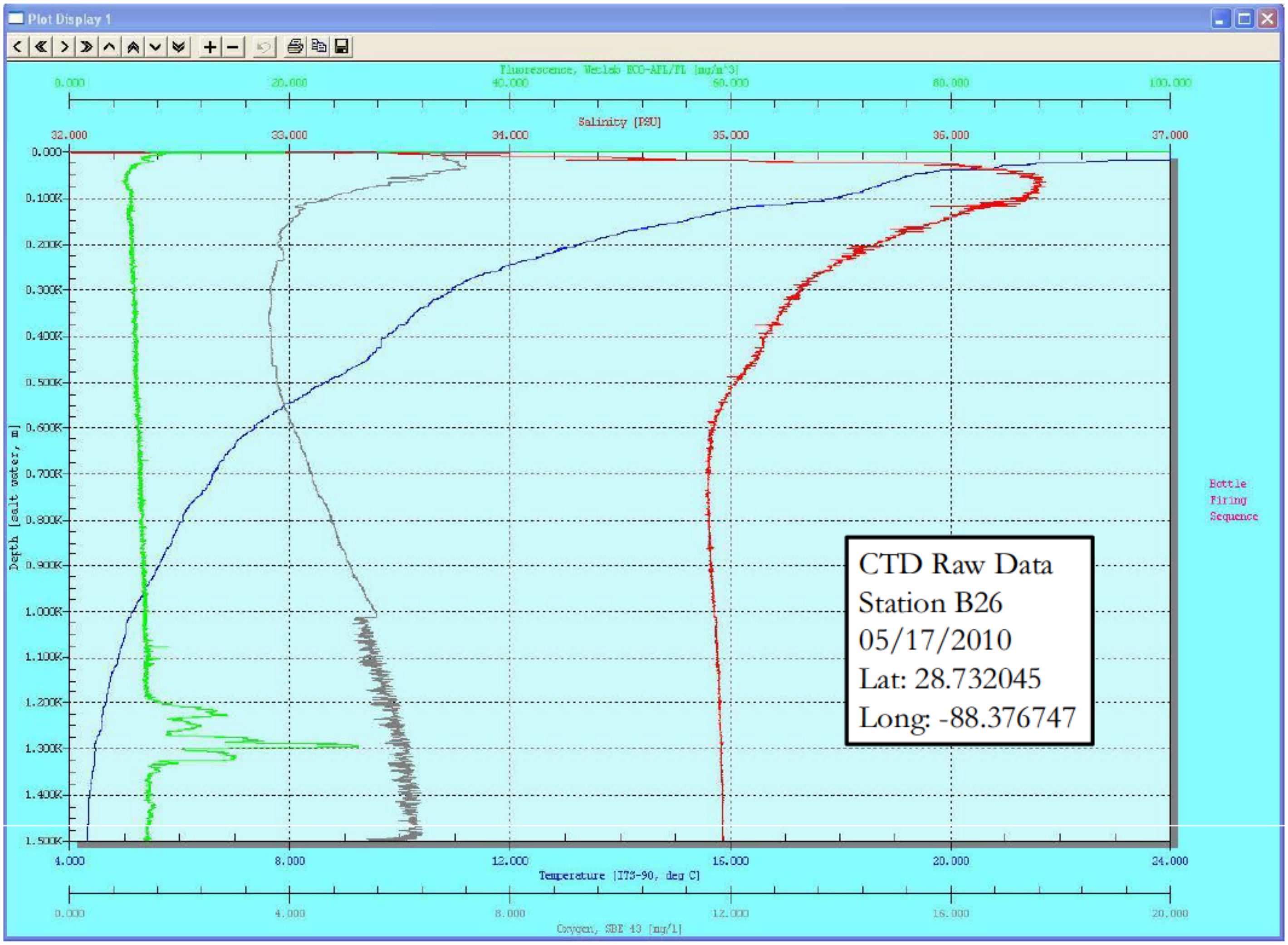
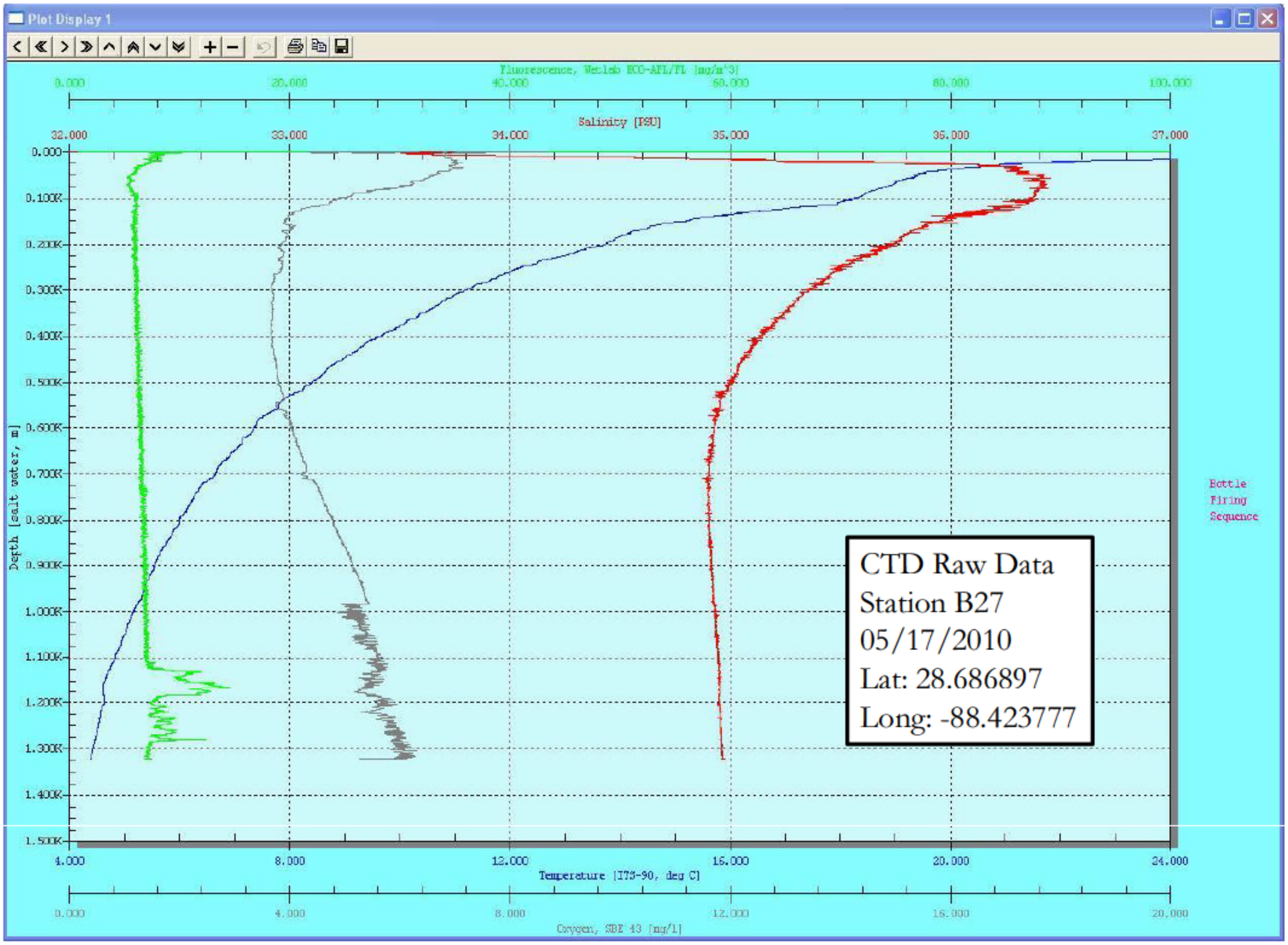


Note: Laboratory values
of <MDL set to 0.01 ug/ml for graphing)

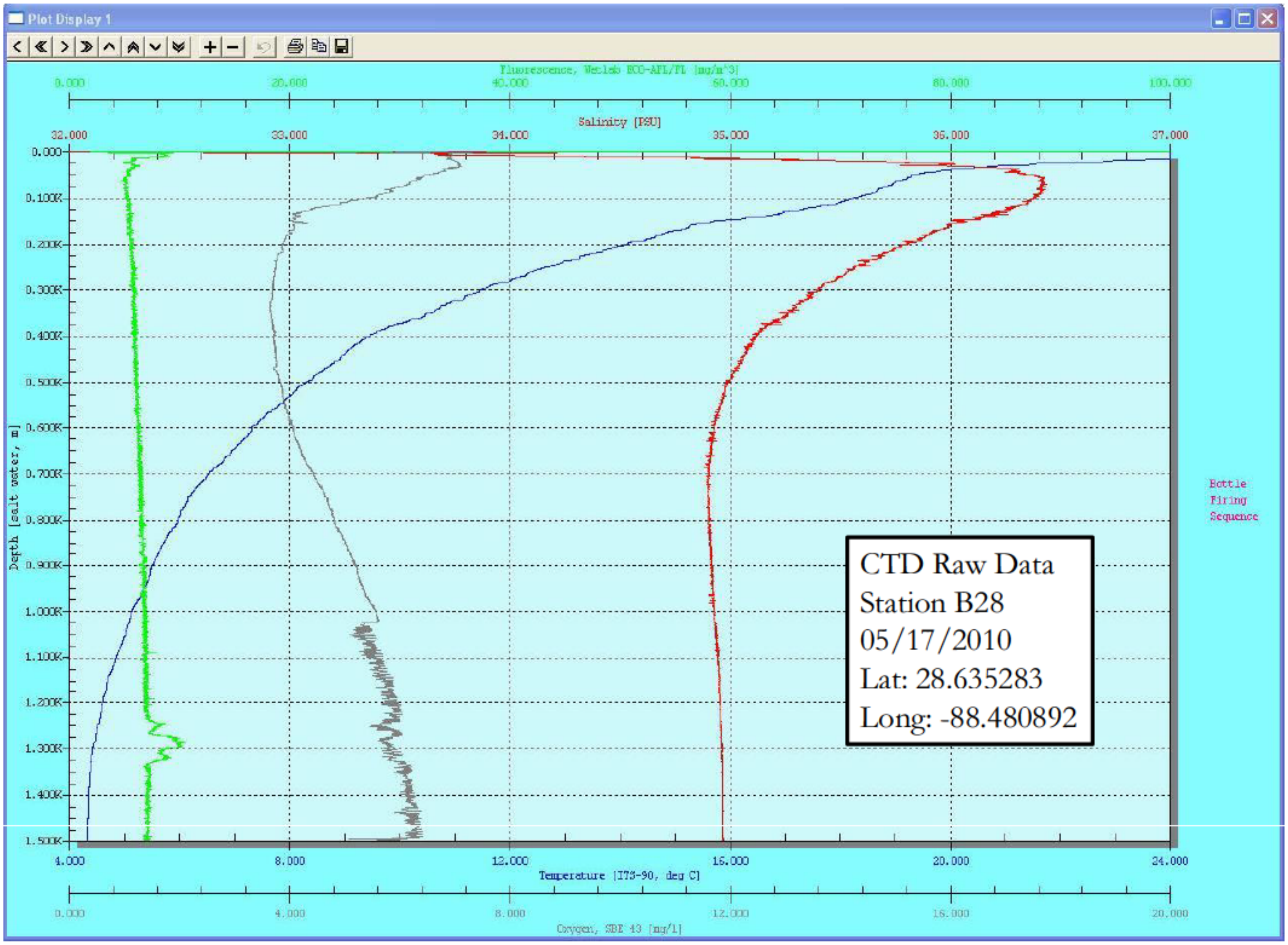


Plot Display 1
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
0.000
20.000
40.000
60.000
80.000
100.000
Salinity [PSU]
32.000
33.000
34.000
35.000
36.000
37.000
Depth [salt water, m]
0.000
0.100K
0.200K
0.300K
0.400K
0.500K
0.600K
0.700K
0.800K
0.900K
1.000K
1.100K
1.200K
1.300K
1.400K
1.500K
Bottle
Firing
Sequence
CTD Raw Data
Station B25
05/17/2010
Lat: 28.566663
Long: -88.000008
4.000
8.000
12.000
16.000
20.000
24.000
Temperature [ITS-90, deg C]
0.000
4.000
8.000
12.000
16.000
20.000
Oxygen, SBE 43 [mg/l]

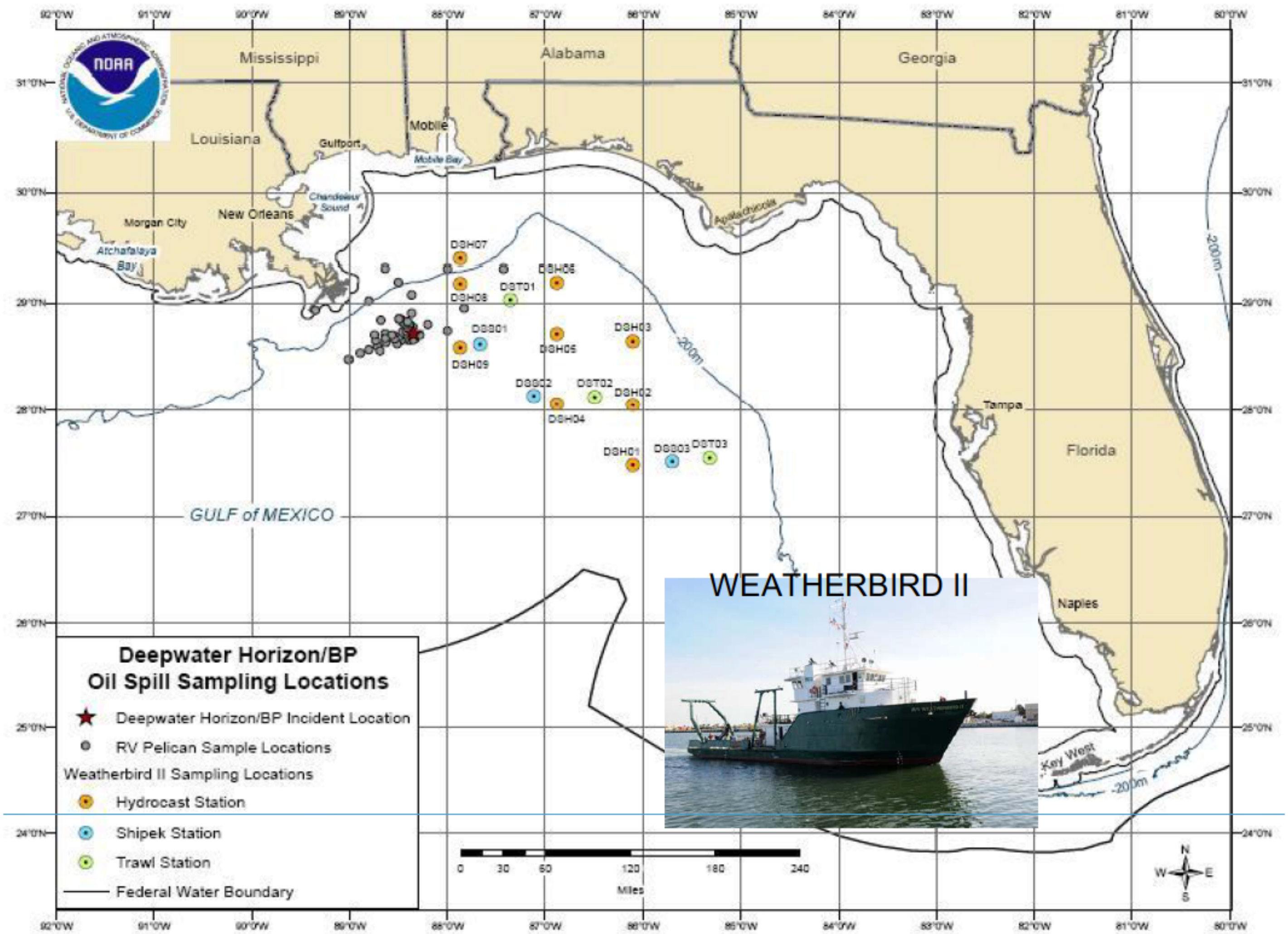

Plot Display 1
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
Salinity [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [mg/l]
Bottle Firing Sequence
CTD Raw Data
Station B26
05/17/2010
Lat: 28.732045
Long: -88.376747



Document ID: 0.7.19.2104.10

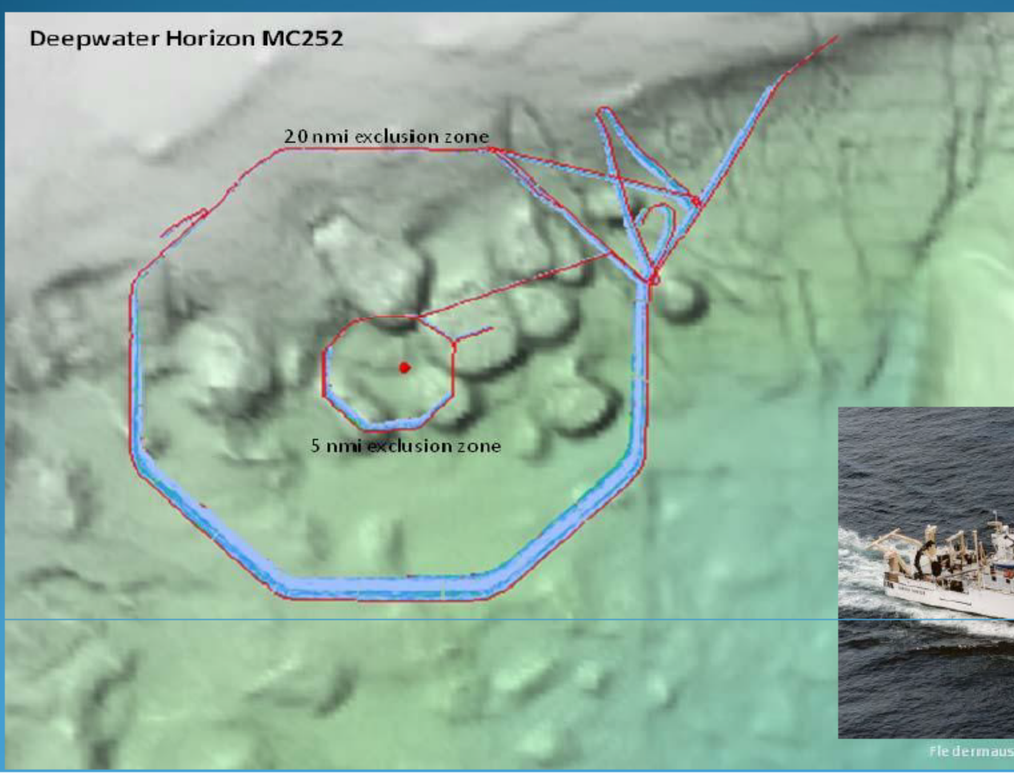


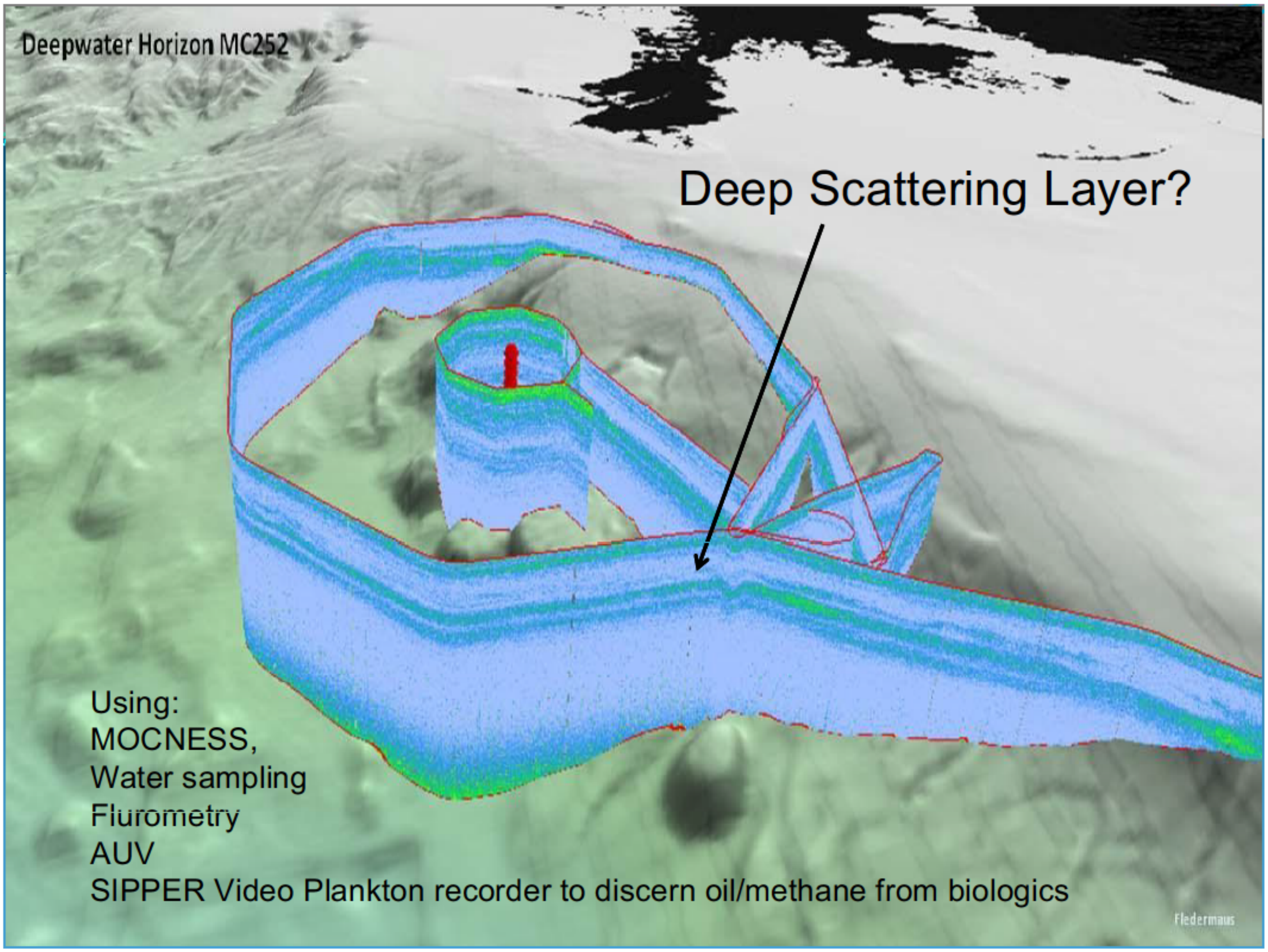
Plot Display 1
Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]
0.000
20.000
40.000
60.000
80.000
100.000
Salinity [PSU]
32.000
33.000
34.000
35.000
36.000
37.000
0.000
0.100K
0.200K
0.300K
0.400K
0.500K
0.600K
0.700K
0.800K
0.900K
1.000K
1.100K
1.200K
1.300K
1.400K
1.500K
Depth [salt water, m]
Bottle Firing Sequence
CTD Raw Data
Station B28
05/17/2010
Lat: 28.635283
Long: -88.480892
4.000
8.000
12.000
16.000
20.000
24.000
Temperature [ITS-90, deg C]
0.000
4.000
8.000
12.000
16.000
20.000
Oxygen, SBE 43 [mg/l]

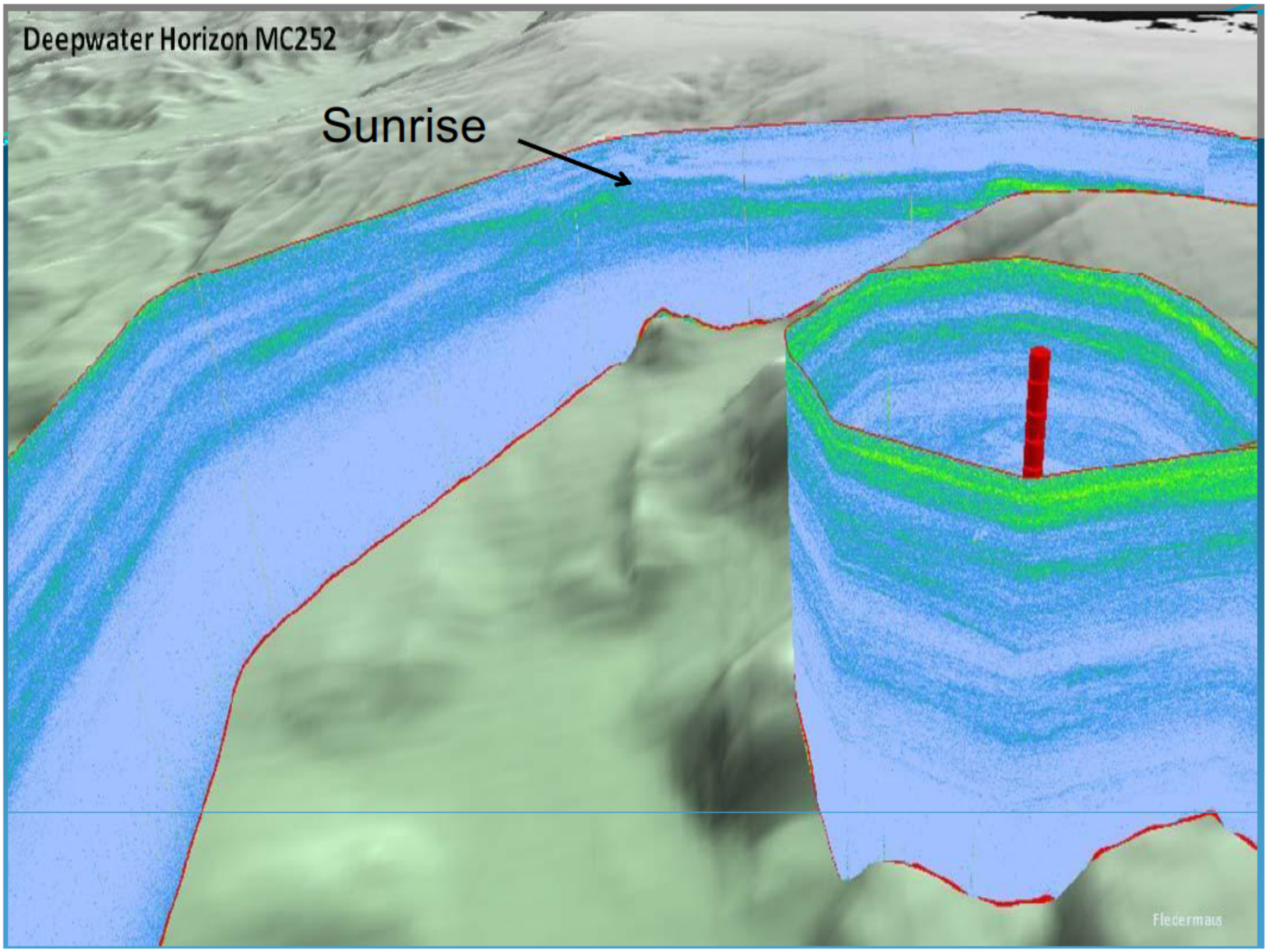


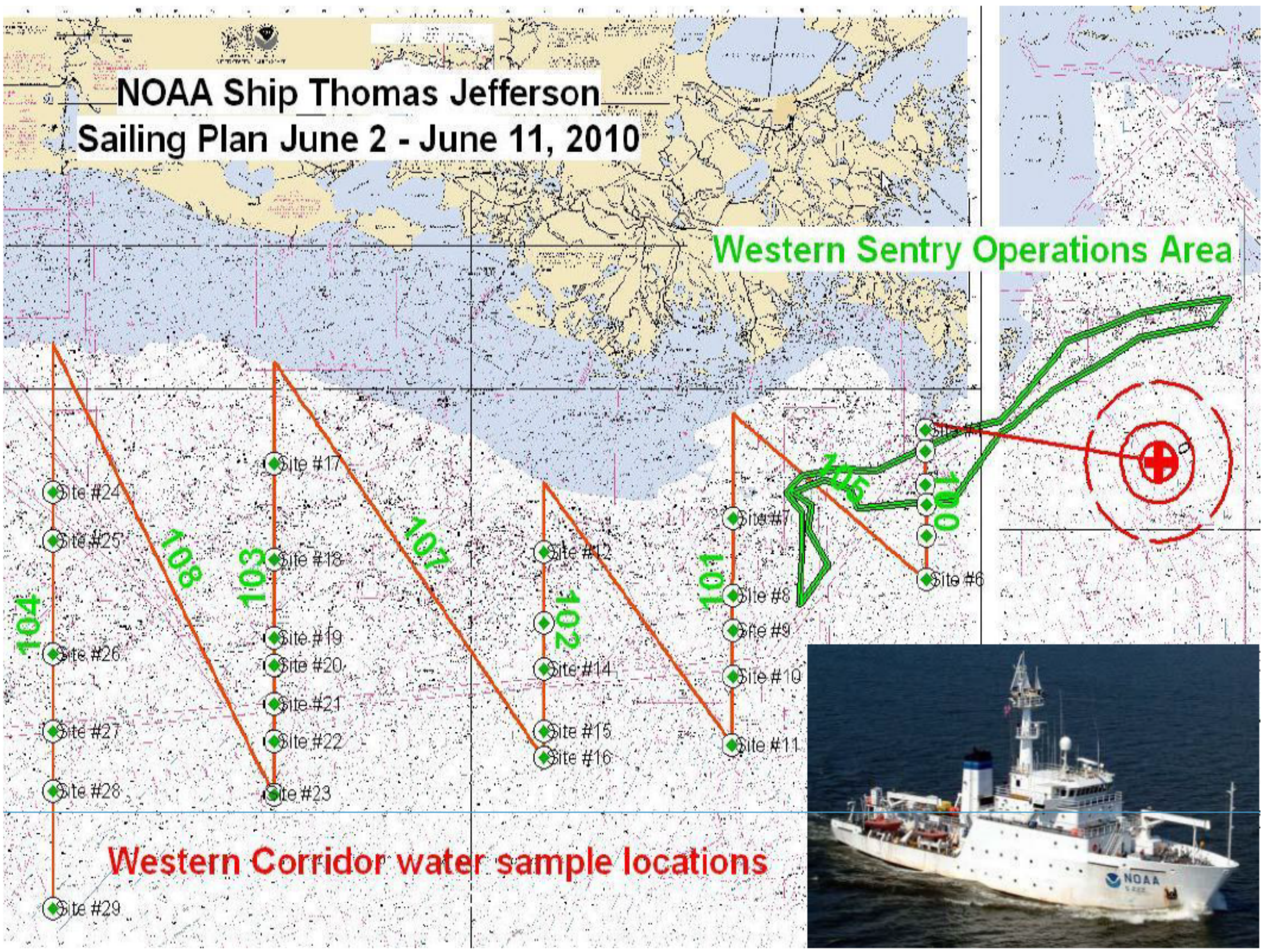
Document ID: 0.7.19.2104.10

Acoustics Cruise aboard GORDON GUNTER
20 nm ring then 5 nm ring



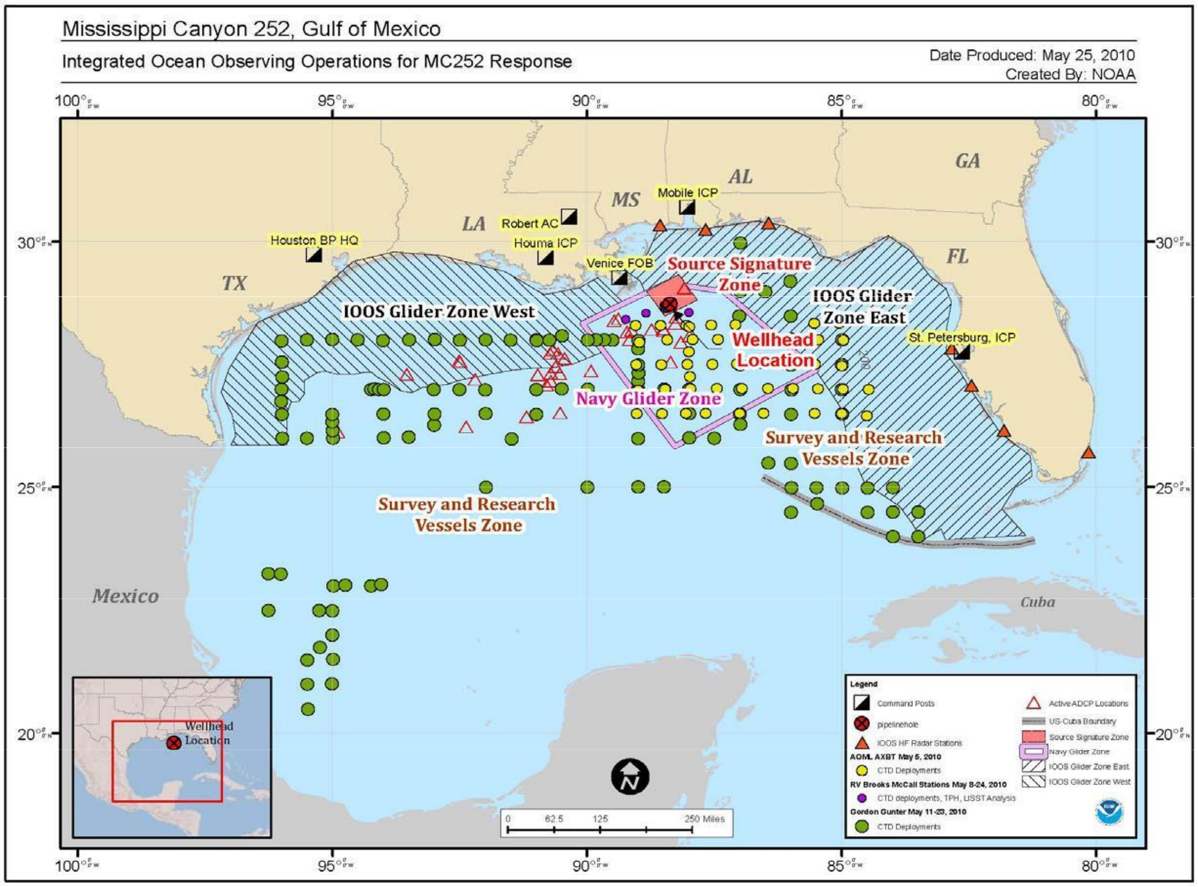

Deepwater Horizon MC252
Deep Scattering Layer?
Using:
MOCNESS,
Water sampling
Flurometry
AUV
SIPPER Video Plankton recorder to discern oil/methane from biologics
Fledermaus


Deepwater Horizon MC252
Sunrise
Fledermaus



Document ID: 0.7.19.2104.10

Greater Awareness of sampling assets



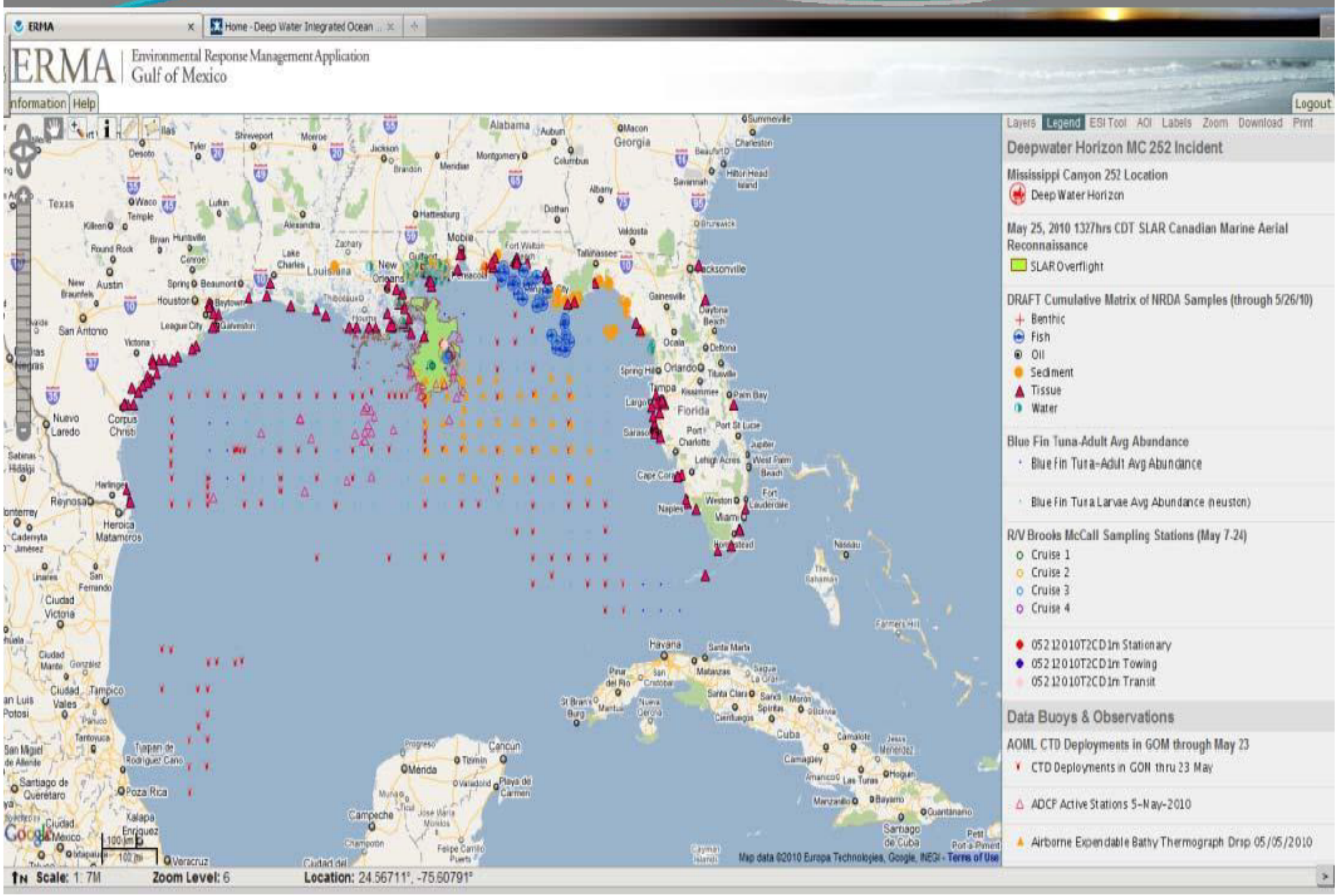
Where are we now with Sub-Surface Sampling?

- All actual sub-surface water sampling results to date indicate low ppm (very near field) to ppb farther, to negative results (farther field)
- Considerable numbers of government, BP and academic assets now devoted to this activity with more being proposed each day
- Some data already collected not usable because of collection and storage protocols
- Tactical situation confused by natural oil/methane, other organic compounds (plasticizers) and biologics in the water column
- Suggest we set up a workshop to review results and harmonize approaches to date before any additional cruises are planned except for required monitoring activities

Near-Term Science Actions 1-6 months)

- Continued scientific support to the IC through USCG Federal On-Scene Coordinator (including trajectory predictions, Loop Current evaluation, predicted shore line impacts, etc.).
- Mass balance calculations to understand surface and sub-surface fractions of total release
- Continued assessment of shoreline oil impacts and support for scientifically appropriate clean-up actions
- Additional studies of the impacts of dispersants
- Continued surveys to assess the magnitude, characteristics, fate, transport and near-term effects of subsurface dispersed oil
- Longitudinal surveys of potential oil and dispersants in seafood species in closed and open areas
- Identification and initiation of studies to quantify natural resource injuries
- Additional human dimensions studies to understand the impact of the event on coastal communities

Collected over 2000 baseline samples



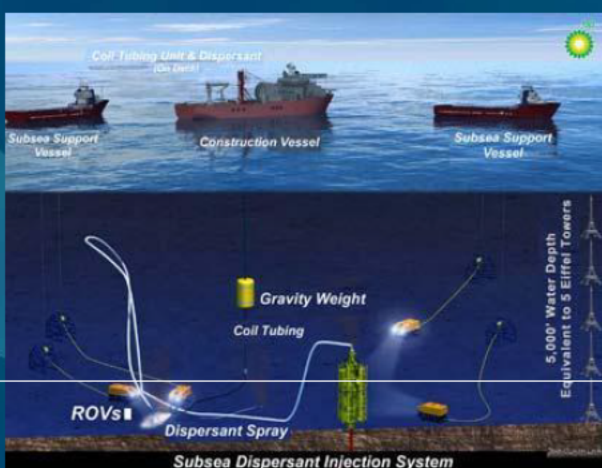
Over 800,000 gallons of dispersants used surface & subsurface
Are there tipping points in the ecosystem?

COREXIT® EC9500A

TECHNICAL PRODUCT BULLETIN #D-4
USEPA, OIL PROGRAM CENTER
ORIGINAL LISTING DATE: APRIL 13, 1994
REVISED LISTING DATE: DECEMBER 18, 1995
"COREXIT® EC9500A"
(formerly COREXIT 9500)

a. Toxicity

Material Tested	Species	LC50 (ppm)
COREXIT® EC9500A	Menidia beryllina Mysidopsis bahia	25.20 96-hr 32.23 48-hr
No. 2 Fuel Oil	Menidia beryllina Mysidopsis bahia	10.72 96-hr 16.12 48-hr
COREXIT® EC9500A & No. 2 Fuel Oil (1:10)	Menidia beryllina Mysidopsis bahia	2.61 96-hr 3.40 48-hr



· BP is using large amounts of COREXIT as a dispersant both at the surface, and two tests were performed at the well head

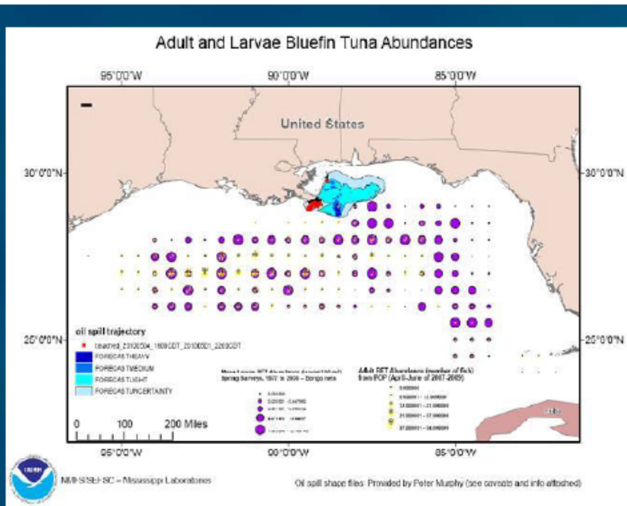
· EPA suspended deep water injection but a significant ongoing issue is the relative impacts of deep vs. surface application

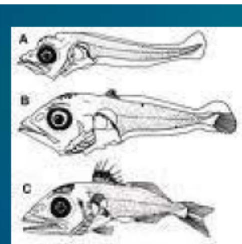
· COREXIT is mildly toxic to silverside fish and a shrimp-like species and some data exist for other species (25-32 PPM result in 50% test mortality)

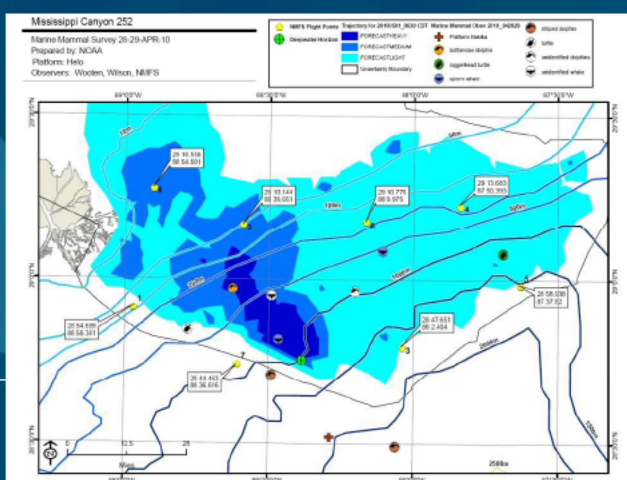
· However, in combination with No 2 crude the result is more toxic than COREXIT only

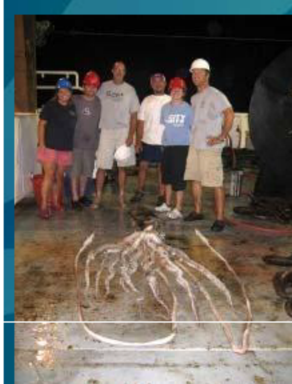
· No toxicity tests with Light Louisiana crude from site

Need Testing to understand long-term impacts









Deep water giant squid

· What resources are potentially at risk for LMRs from the dispersal of oil and dispersants and the synergy?

· BFT spawning in the region offshore from the spill from April-June – NOAA FSV GORDON GUNTER cruise completed

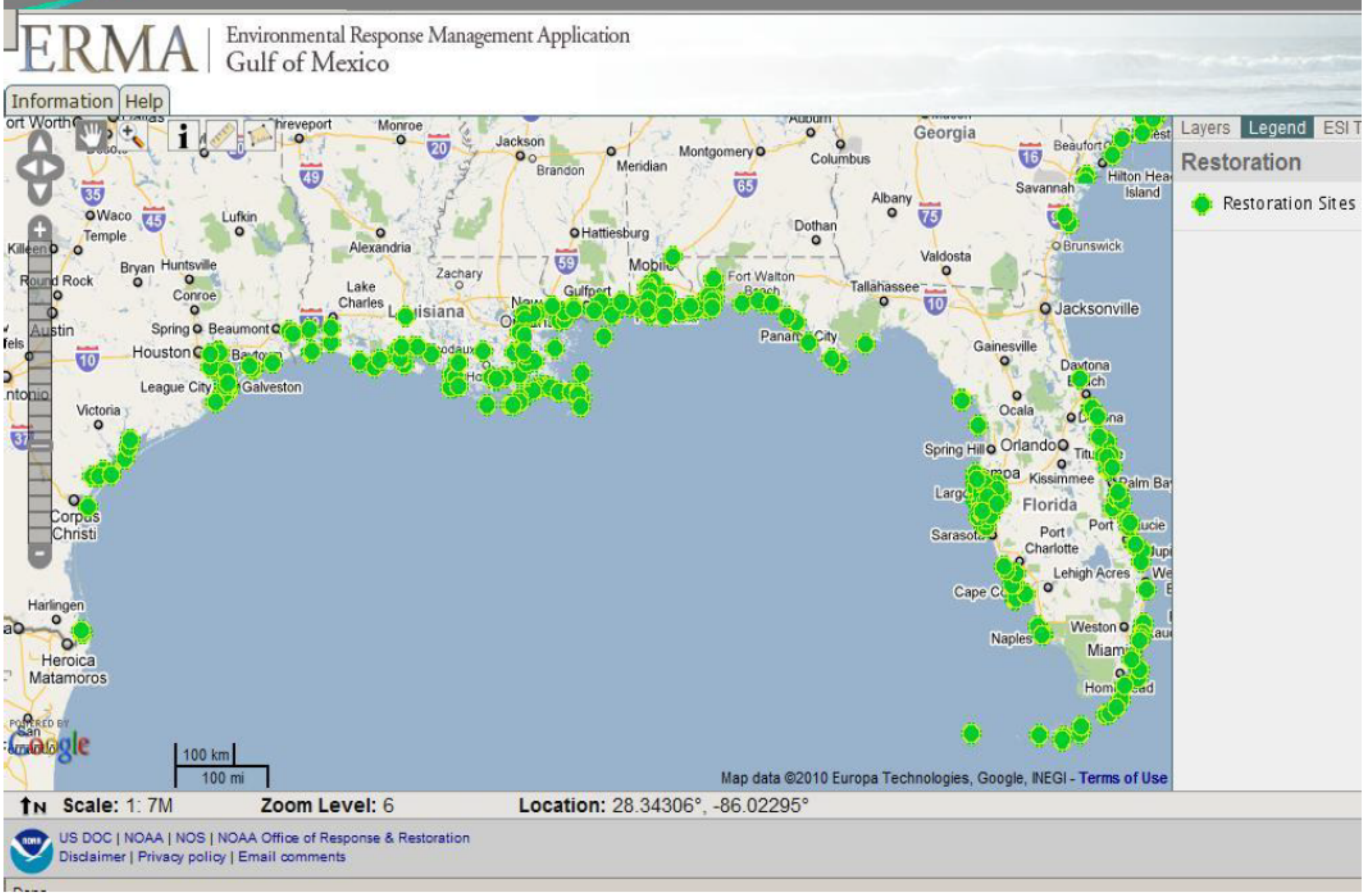
· Samples of sperm whale tissue and squids available from cruise last summer and winter as baselines

· Overflights continue to monitor protected species

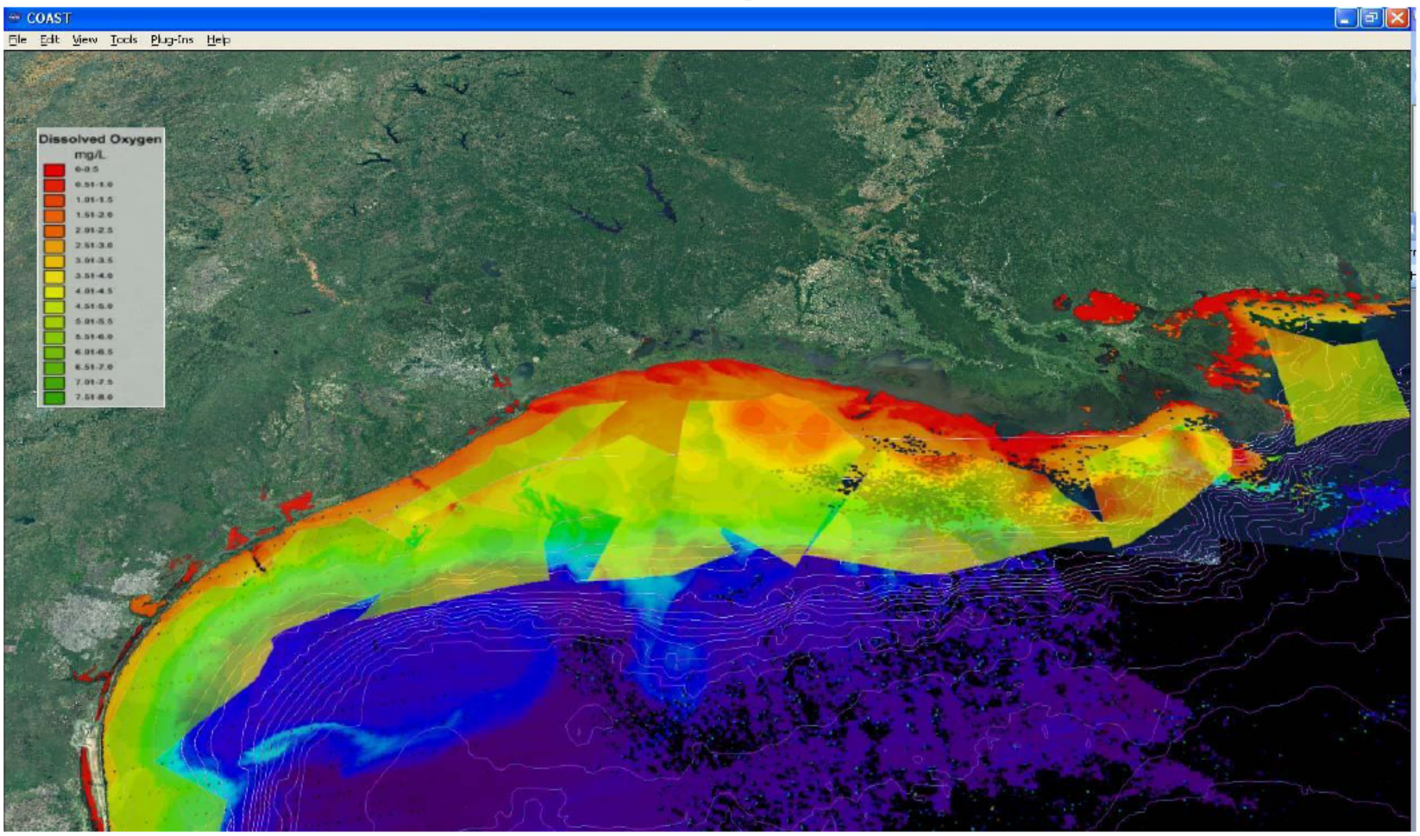
Long-Term Science Actions (2 mos. to decades)

- Ecosystem-level Impacts of the spill
  - Impacts of the spill on productivity, nutrient cycling and species composition near and off-shore habitats
  - Impacts of the spill on productivity, nutrient cycling and species composition of Louisiana marshes
- Development and implementation of ecosystem-level restoration opportunities for the Northern Gulf of Mexico
- Studies to identify on long-term effects of introduction of tons of reduced carbon into the Gulf ecosystem
  - Effects on Hypoxia distribution and seasonality in the GOM
  - Effects on HABs and other human health pathogens
- Mid to long term socio-economic impacts of the spill on coastal Gulf Coast States

Many Restoration Sites Already Exist – Best Remediation Practices?



Effects of Spill on an area already challenged by hypoxia



We Need a more Holistic Ecosystem Approach to Understanding Long-Term Impacts

Document ID: 0.7.19.2104.10

Received(Date): Thu, 03 Jun 2010 13:04:52 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Update June 2

Today's report contains two items:

1) Press release regarding funding for Louisiana Barrier Islands proposal.

2) Daily update

Additional resources:

www.bp.com/gulfofmexicoresponse

www.deepwaterhorizonresponse.com

Press Release - June 2, 2010

BP AGREES TO FUND CONSTRUCTION OF SIX SECTIONS

OF LOUISIANA BARRIER ISLANDS

BP today announced that it supports the U.S. government's decision to proceed with the construction of six sections of the Louisiana barrier islands proposal. The company will fund the estimated $360 million it will cost to construct the six sections.

BP will not manage or contract directly for the construction of the island sections, nor will the company assume any liability for unintended consequences of the project. The company plans to make payments in stages based on the project's milestones.

"BP is committed to implementing the most effective measures to protect the coastline of Louisiana and reduce the impact of the oil and gas spill in the Gulf of Mexico. The federal government and the state of Louisiana have agreed that the barrier islands construction is an effective response to the spill, and we look forward to working with them on this project," said Tony Hayward, BP's chief executive officer.

BP already has provided $170 million to Louisiana, Alabama, Mississippi, and Florida to help with their response costs and help promote their tourism industries. The company also has paid approximately $42 million in compensation to people and companies affected by the spill.

- ENDS -

Gulf of Mexico Oil Spill Response Update

06/02/2010 – 10:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the sea floor to stop the flow of oil through various strategies;

2. On the surface to minimize impacts of the spill; and

3. Onshore to protect the shoreline and inform the public.

Highlights

ξ Lower Marine Riser Package Cap procedure continues.

ξ BP to provide $360 million to fund six sections of Louisiana Barrier Islands Proposal.

ξ $40 million in claims paid – see state-by-state breakdown.

ξ Subsea dispersant use continues.

ξ Over 18,000 total personnel working on response, plus an additional 15,555 volunteers signed up to date.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

ContainmentRecovery Systems

Lower Marine Riser Package (LMRP) Cap containment option now being actively deployed involves removing the damaged riser from the top of the BOP, leaving a cleanly-cut pipe at the top of the BOP's LMRP over which the cap will be placed. The cap is an engineered containment device which will be connected to a riser from the Discoverer Enterprise drillship (see www.bp.com for graphics) with the intention of capturing most of the oil and gas flowing from the well and transporting it to the drillship on the surface.

Operationssummary: the riser shear cut was completed at 7:30 pm CDT on June 1; the diamond saw blade became stuck around 12:05 am CDT on June 2. At the time, work had succeeded in cutting about 45% of the riser. Work progressed to dislodge the blade until approximately 12:30 pm CDT on June 2; The diamond saw and shears are being retrieved to surface and preparations are underway to resume cutting the riser.

Two further containment strategies are planned:

ξ **Q 4000 Direct Connect**: this option will use the hoses and manifold that were deployed for the 'top kill' operation to take additional oil flow directly from the failed Deepwater Horizon blow-out preventer (BOP) through a separate riser to the Q4000 vessel on the surface. This system, currently expected to be available for deployment in mid-June, is intended to increase the overall efficiency of the containment operation by possibly increasing the amount of oil and gas flow that can be captured from the well.

ξ **Long-term Containment Option**: this operation will take oil from the LMRP via a manifold to a new free-standing riser ending approximately 300 feet below sea level. A flexible hose will attach it to a containment vessel at surface. This long-term option is designed to more effectively disconnect and reconnect the riser to provide the greatest flexibility for operation during a hurricane. Implementation is expected in late June or early July.

Dispersant injection on the sea floor – dispersant use at the subsea leak source continues. EPA is allowing subsea application of the currently-used dispersant to continue.

Drilling relief wells

ξ The first relief well (work being performed by the *Development Driller III*) is at approximately 12,000 feet below sea level and drilling. This well was "spudded" on May 2.

ξ The second relief well (work being performed by *Development Driller II*) is at approximately 8,600 feet below sea level and drilling. Drilling began on May 16.

ξ Both wells are situated approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below seal level. It is estimated the total drilling process for each well will take at least 90 days

Offshore – Surface Spill Response

Cleanup Vessels – approximately 1,783 response vessels are now deployed (tugs, barges and recovery boats). 120 skimmers are in use.

Skimming Operations – 9,006 barrels of oily-water mix collected yesterday. Total to date = 338,848 barrels.

Surface Dispersant – No surface dispersant was applied yesterday. Over 360,000 gallons of dispersant remain available.

In-Situ Burning – The Unified Command conducted 4 in-situ burns on Tuesday. In-situ burning occurs on the surface using special fire-boom that collects surface hydrocarbons which are then burned.

Onshore - Shoreline Protection and Community Outreach

Louisiana Barrier Island Project Funding - BP today announced that the company will fund the estimated $360 million in costs to construct six sections of the Louisiana Barrier Islands proposal.

Shoreline Impacts – in addition to ongoing impacts in Louisiana; tar balls were observed on Dauphin Island, Alabama.

Shoreline Protection – Coast Guard and BP are redoubling efforts with additional senior operations managers coming into field locations to improve responsiveness and speed cleanup operations. The response organization has been restructured into three main branches - east, west and offshore. Additional forward operating bases and staging areas are being established in western Louisiana.

Boom Report – over 2,002,946 feet of containment boom has been deployed (with an additional 627,105 feet staged). Over 2,192,430 feet of sorbent boom has been deployed (with an additional 1,777,280 feet staged)

Claims

ξ **Over $40 million in claims paid.** Note: see chart below for claims paid by state

ξ 500 claims adjustors are working across the Gulf Coast, 125 operators are answering phone calls.

ξ BP has 24 claims offices (across LA., MS., AL., FL.) open to help claimants through

the process. Most claims are for loss of income or wages in commercial fishing, shrimping and oyster harvest, and associated facilities. Note: No person asserting a claim or receiving payment for interim benefits will be asked or required to sign a release or waive any rights to assert additional claims, to file an individual legal action, or to participate in other legal actions associated with the Deepwater Horizon incident. The contact number for claims is (800) 440-0858. In person claims can be filed at office locations listed below. Claims can also be filed online at: http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138

Claims by State

State	Number of Checks	Amount Paid	Average Paid
LA	7,527	$24,016,372	$3,191
AL	2,710	$7,151,808	$2,639
MS	1,769	$4,775,148	$2,699
FL	1,099	$3,519,815	$3,203
TX	174	$549,900	$3,160
GA	20	$57,500	$2,875
Other	52	$175,500	$3,375
Grand Total	13,351	$40,246,043	$3,014

Total costs: the cost of the response to date amounts to approximately $1 billion, including the cost of the spill response, containment, relief well drilling, grants to the Gulf states, claims paid and federal costs.

State specific websites established - BP today announced four informational web sites designed to offer state-specific (LA., MS., AL., FL) oil spill information to residents of communities affected by the Deepwater Horizon oil spill. Residents are encouraged to visit these sites frequently and sign up for the mailing list to receive the most current information about the spill response. These sites are dedicated to providing information about activities and events most important to residents of each state.

Alabama: www.alabamagulfresponse.com
Florida: www.floridagulfresponse.com
Louisiana: www.louisianagulfresponse.com
Mississippi: www.mississippigulfresponse.com

Independent Claims Mediator established - BP is appointing an Independent Mediator so that we have as fair a process as possible for everyone in the Gulf region. BP has always said will pay legitimate claims for loss and damage caused by the spill, and we're committed to paying claims promptly. In those cases in which a claimant and BP cannot agree on resolution of a claim, the mediator is a way for them to get an independent review.

$500 Million for 10-year Research Program to Study Spill Impacts – BP is contributing $500 million over 10 years to fund an open research program studying the impact of the Deepwater Horizon incident, and its associated response, on the marine and shoreline environment of the Gulf of Mexico. In

coordination with other baseline efforts underway, BP will enter into programs with Louisiana State University, and other gulf coast research institutions, to establish a baseline of the coastal and marine ecosystem to serve as a control against which future impacts will be assessed.

BP Provides $70 million in Tourism Grants to States – BP has made $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism.

$25 Million Block Grants to 4 States – On May 4, BP announced it would provide Louisiana, Florida, Mississippi and Alabama $25 million each to accelerate implementation of the States' Area Contingency Plans.

"Vessels of Opportunity" Program – Over 5,000 contracts have been signed and nearly 1,000 vessels are currently active. Community Outreach Centers are working with the contractors to ensure they have the appropriate training.

Volunteers and Training – Over 18,000 total personnel working on response, plus an additional 15,555 volunteers signed up to date. BP has opened 22 Community Outreach Centers across the Gulf where people can go for more information, to find out about the spill, and to connect with volunteer opportunities. Volunteers are being trained in five different modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

Wildlife Activities – 25 new wildlife impacts reported yesterday. Wildlife rehabilitation sites are located in Venice, LA and Mobile, AL.

Summary of Regional Operations and Outreach				
Louisiana Sites:	Robert – Unified Area Command			
		Houma – Incident Command Post		
				Pointe A La Hache – Community Outreach Center
				Venice – Community Outreach Center, Staging Area
				Grand Isle – Staging Area
				Port Fourchon – Staging Area
				Cocodrie – Staging Area
				Shell Beach – Staging Area
				Slidell – Staging Area
				St. Mary – Staging Area
				Amelia – Staging Area
			Belle Chasse – **Claims Office**	

	2766 Belle Chasse Hwy Belle Chasse, LA 70037
	Cut Off – **Claims Office** Tarpon Heights Shopping Center Unit 2 16263 E. Main Street Cut Off, LA 70345
	Grand Isle – **Claims Office** 3811 LA 1 Grand Isle, LA 70358
	Hammond – **Claims Office** Worley Operations Center 303 Timber Creek Hammond, LA 70404
	Houma – **Claims Office** Plaza Caillou Shopping Center 814 Grand Caillou Road Suite 2 & 3 Houma, LA 70363
	New Orleans – **Claims Office** 4375 Michoud Blvd New Orleans, LA 70461
	Slidell – **Claims Office** 2040 Gause Blvd., Suite 10 Slidell, LA 70461
	St. Bernard – **Claims Office** 1345 Bayou Rd Saint Bernard, LA 70085
	Venice – **Claims Office** 41093 Hwy LA 23

	Boothville, LA 70038

Mississippi Sites:	Pascagoula – Community Outreach Center, Staging Area
	Biloxi – Community Outreach Center, Staging Area
	Waveland – Community Outreach Center
	Pass Christian – Staging Area
	Bay St. Louis – **Claims Office** 1171 Highway 90 Bay St. Louis, MS 39520
	Biloxi – **Claims Office** 920 Cedar Lake Rd, Suite K Biloxi, MS 39532
	Pascagoula – **Claims Office** 5912 Old Mobile Hwy Suite 4 Pascagoula, MS 39563

Alabama Sites:	Mobile – Incident Command Post, Community Outreach Center
	Theodore – Staging Area
	Orange Beach – Staging Area
	Dauphin – Staging Area
	Bayou LaBatre – **Claims Office** 13290 N. Wintzell Avenue Bayou LaBatre, AL 36509

Foley – **Claims Office** (Orange Beach/Gulf Shores/Bon Secour) 1506 North McKenzie Street (HWY 59), Suite 104 Foley, AL 36535	Gulf Shores / Orange Beach – **Claims Office** 24039 Perdido Beach Blvd Suite 1 Orange Beach, AL 36561

Florida Sites:	St. Petersburg – Incident Command Post
	Pensacola – Community Outreach Center, Staging Area
	Panama City – Staging Area
	St. Joe – Staging Area
	St. Marks – Staging Area
	Apalachicola – **Claims Office** 194 14th Street Suite 105 Apalachicola, FL 32320
	Crawfordville – **Claims Office** 3010 Crawfordville Hwy Suite A&B Crawfordville, FL 32327
	Ft. Walton – **Claims Office** 348 SW Miracle Strip Pkwy Suite 13 Fort Walton Beach, FL 32548
	Gulf Breeze – **Claims Office** 5668 Gulf Breeze Pkwy Unit B-9 Gulf Breeze, FL 32563

Panama City – **Claims Office** 7938 Front Beach Road Panama City Beach, FL 32408	
	Pensacola – **Claims Office** 3960 Navy Boulevard Suite 16-17 Pensacola, FL 32507
	Port St. Joe – **Claims Office** 106 Trade Circle Suite A Port St. Joe, FL 32456
	Santa Rosa Beach – **Claims Office** 5008 US Hwy 98W Unit 6&7 Santa Rosa Beach, FL 32459

Contact Information	
Environment / Community Hotline – to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife – to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers – to request volunteer information	(866) 448-5816
Services – to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity – to report and register boats available to assist with response	(281) 366-5511
Training – for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit – File online at http://www.horizonedocs.com/index.html	
Investor Relations	(281) 366-3123
Claims – by phone	(800) 440-0858
Claims – http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138	
Joint Information Center – Robert, LA – Media and information center	(985) 902-5231 or (985) 902-5240
Joint Information Center – Mobile, AL – Media and information center	(251) 445-8965
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765
BP Family – and third-party contractor hotline	(281) 366-5578

Twitter: Oil_Spill_2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Karen St John

BP America

Sr. Director, Regulatory Affairs

[redacted]

[redacted] (cell)

stjohnk@bp.com

Received(Date): Thu, 03 Jun 2010 12:18:43 +0000
From: Allison.Reed@noaa.gov
Subject: Export TP
To: "Sarri, Kristen" <KSarri@doc.gov>, Scott.Smullen@noaa.gov
Cc: "Rapp, John" <John.Rapp@noaa.gov>, "Turner, James" <James.Turner@noaa.gov>

The U.S. Government is finalizing protocols to prevent tainted products from entering the marketplace. The protocols include closing affected areas of the Gulf of Mexico to commercial fishing, sampling of the waters of the Gulf of Mexico, sampling of fisheries species of the Gulf of Mexico, and sampling of products in the marketplace. Analytical and sensory methods are based on internationally accepted criteria.

All consumers should expect commercially available Gulf seafood to be of the same quality that people have come to expect from the Gulf.

NOAA continues to monitor the health of the commercial fish stocks within the United States Exclusive Economic Zone (EEZ). While we do not have complete data yet, we have not yet seen any effect on fish stocks outside of our closed areas although we continue to monitor.

Sent from my Verizon Wireless BlackBerry

-----Original Message-----
From: Allison Reed <Allison.Reed@noaa.gov>
Date: Wed, 02 Jun 2010 16:41:32
To: Sarri, Kristen<KSarri@doc.gov>
Cc: Rapp, John<John.Rapp@noaa.gov>; Spring, Margaret<Margaret.Spring@noaa.gov>; Smullen, Scott<Scott.Smullen@noaa.gov>; Oil spill staff (dwh.staff@noaa.gov)<dwh.staff@noaa.gov>; Griffis, Kevin<KGriffis@doc.gov>; Schwaab, Eric<Eric.Schwaab@noaa.gov>; Medina, Monica<Monica.Medina@noaa.gov>; Lugo, Lauren<Lauren.B.Lugo@noaa.gov>; Wilson, Steven<Steven.Wilson@noaa.gov>; Turner, James<James.Turner@noaa.gov>
Subject: Re: URGENT -- Seafood Safety Talking Points

With respect to the international component, I would suggest the following (which is derived partially from language in a cable State sent to posts on 13 May, as well as language from the draft seafood export cable. However, I understand that the language might need to be changed to reflect the fact that the protocols are already "finalized" and I also understand that the export cable is now undergoing NOAA clearance again and there might be issue taken with the use of the term "marketplace.")

The U.S. Government is finalizing protocols to prevent tainted products from entering the marketplace. The protocols include closing affected areas of the Gulf of Mexico to commercial fishing, sampling of the waters of the Gulf of Mexico, sampling of fisheries species of the Gulf of Mexico, and sampling of products in the marketplace. Analytical and sensory methods are based on internationally accepted criteria. The program is also finalizing strict protocols for the reopening of areas closed to commercial fishing. Fishing grounds will be reopened ONLY when levels of contaminants are within safety parameters as identified by regulatory agencies. Consumers should expect commercially available Gulf seafood to be of the same quality that people have come to expect from the Gulf.

NOAA continues to monitor the health of the commercial fish stocks
within the United States Exclusive Economic Zone (EEZ). While we do not
have complete data yet, we have not yet seen any effect on fish stocks
outside of our closed areas although we continue to monitor.

Hope this helps
Allison

Sarri, Kristen wrote:
>
> We have a process for clearing seafood talking points and Q&As.
>
> Scott and John if you can work together with the appropriate NOAA
> staff (John, Lauren, and Steve) that would be great.
>
> We need to merge our TPs and Q&As with FDAs on seafood safety. Once we
> work with FDA on this and the document is agreed to by us and FDA then
> we will send to WH for clearance.
>
> To the document that we already have (Scott is QB), we need to add a
> TP and Q&A that address that US seafood is safe and international
> concerns that are being raised.
>
> Also, if we want to release the baseline data to the states then we
> also need to add TP and Q&As on baseline data per Nance Beck's request
> yesterday (John Rapp has this information).
>
> Can we get this done with FDA in the next 90 minutes?
>
> --
>
> *From:* John Rapp [mailto:John.Rapp@noaa.gov]
> *Sent:* Wednesday, June 02, 2010 3:48 PM
> *To:* Spring, Margaret
> *Cc:* Oil spill staff (dwh.staff@noaa.gov); Sarri, Kristen
> *Subject:* Re: tps on seafood safety?
>
> Here are two docs that have seafood safety talkers. There are more in
> the hopper, but they're probably at least 24 hours away from being
> cleared.
>
> John
>
> Margaret Spring wrote:
>
> What do we have in the can that I could send up above?
>
> Margaret Spring
>
> Chief of Staff
>
> National Oceanic and Atmospheric Administration
>
> U.S. Department of Commerce
>
> 14th & Constitution Avenue NW, Room 5128

>
> Washington, DC 20230
>
> [redacted]
>

--
Allison Reed
International Affairs Specialist
National Oceanic and Atmospheric Administration
Department of Commerce

[redacted]

Received(Date): Thu, 03 Jun 2010 09:11:42 -0400
From: ICC Deputy <ICC.Deputy@noaa.gov>
Subject: June 2 ICC SITREP
To: Deepwater.HorizonDist@noaa.gov
June 2 slb SITREP.pdf

FOR OFFICIAL USE ONLY

CDR Mike Weaver

--
ICC Deputy on Watch
ICC Main Number: (301) 713-0136

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through 02 June 2010

- (NMFS) It is becoming increasingly apparent to the Marine Mammal and Sea Turtle Health and Stranding Response Program, based on on-water observations and enhanced understanding of cleanup operations (i.e., skimmer vessels and surface burns), that sea turtles are being significantly impacted including substantial takes. For example, the material that is being targeted by at least some of the in situ burn operations is the same surface material (rafts of *Sargassum*, oil, weathered oil, and mousse) that is being recovered on live, oiled turtles.
- (NMFS) The National Seafood Inspection Laboratory processed 416 field samples and shipped them to the Northwest Fishery Science Center (NWFSC) for PAH analysis; 118 field samples were provided to the Seafood Inspection Program (SIP) for sensory analysis; 640 field samples were received from 18 vessel trips; and 224 field samples are still to be processed. In addition, SIP sensory experts began the first of the state sensory training sessions today, June 2, 2010, in Pascagoula, MS. This first class has 20 participants from MS, AL, and TX. Two other sessions are planned for next week again in Pascagoula.
- (NOS) Gulf Coast Services Center staff facilitated the town-hall meeting on June 1, 2010, in Slidell, LA. Approximately 200 participants sought information at more than 20 "issue stations" from Subject-Matter Experts.
- (NOS) Three NCCOS researchers are aboard two BP-contracted vessels, TDI-Brooks' R/V Brooks McCall and Stabbert Maritime's R/V Ocean Veritas to characterize the water column in the vicinity of the continuing spill to locate and characterize the sub-sea plume and dispersant concentrations in areas around the former Deepwater Horizon rig site.
- (NOS) The Brooks McCall team member successfully sampled 5 stations within 10 km of the Deepwater Horizon wellhead. Sub-surface oil spill plume detected at 2 of the 5 stations. Southwestern edge of plume extent successfully delineated. Conditions on site remain noxious.

Fisheries Closure

- A change in the Fisheries closure area took place last night at 6 pm EDT. The new closure area covers about 37% of the GOM EEZ which is up from the last closure area of 31% of June 1.

NOAA Ship Gordon Gunter

- Gordon Gunter has completed 642nm of Acoustic survey on its sub-surface oil sampling cruise in addition to its full suite of sampling operations.
- The ship remains on target for scheduled endurance until June 04.
- Operating around the 5NM Exclusion Zone and an area to the SSW. Conducting the full suite of sampling operations. Acoustic signatures with potential as sub-surface plumes being sampled extensively.
- Operational details as follows: CS reporting data/results summary through ICC.
    - 642nm of Acoustic Survey Completed
    - 24 XBT Casts
    - 23 CTD Casts
    - 3 MOCNESS Tows
    - 7 Sub Surface Neuston Tows
    - AUV Gulper Survey Hours: 26
    - SIPPER Survey Hours: 15

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through 02 June 2010

- Participating in daily calls with UC Environmental Unit (Pickett)
- 1800 Gallons used in the sixth 24 hrs. Total used 8,500. Remaining 5,500. On target for scheduled endurance until 04JUNE
- Equipment has only been "lighlty" oiled. HAZMAT controls working well.
- Requested VOC monitoring device via UC due to strong odors while operating in certain areas.
- PCO coordinating likely Dr. Lubchenco visit to GU on Friday afternoon, once the ship is alongside Singing River Island.

NOAA Ship Thomas Jefferson

- Departed at 0600 EDT on June 3 for DWH "Western Sentry" project.

R/V Gandy

- Conducting Reef Fish Survey out of Panama City, FL

R/V's Caretta

- Alongside Pascagoula prepping for TED Certification cruise. Scheduled to assist with spill response after 21 June.

R/V HST

- Alongside Pascagoula. Available. Suitable for coastal day trips.

R/V Harold B

- Coming out of shipyard this week. Scheduled to conduct trap/video surveys out of Panama City the remainder of the month. Vessel suitable for nearshore, day trips.

R/V Beau Rivage

- Concluding trawling in non-oiled areas to collect baseline samples for the National Seafood Inspection Laboratory. ETA Pascagoula 04 June.

R/V Jack Fitz (a CSA International vessel)

- Alongside in Port Fouchon

R/V Pelican

- Starting a 5-day cruise for FUGRO today

Gliders

- 2 IOOS community gliders (Rutgers and Mote) & 2 NAVO gliders on active missions and transmitting data

Aircraft Operations Summary

- Total flight time flown for 02 Jun 2010: 5.6 Hours
- Total flight time scheduled for 03 June : 23.0 Hours
- Total DWH/PEE flight time to date: 324.3 hrs
- OAR/OMAO are planning another P-3 flight for Thursday 03 Jun

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through 02 June 2010

Financials

As of COB 31 MAY, Obligations to Deepwater Horizon Funding Codes:

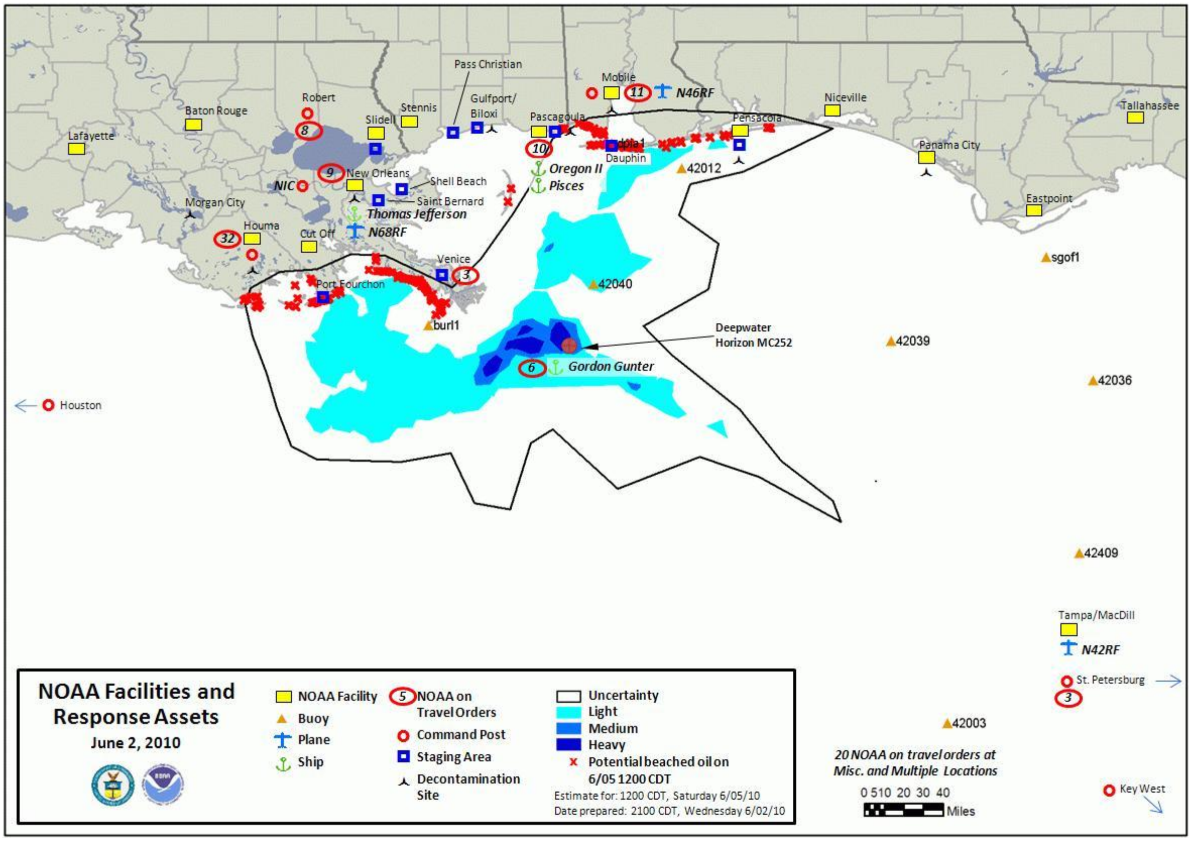
- ORF Total $1.8M
- Reimbursable Total $3.2M
- Grand Total $5.0M

Personnel

- Employee billed hours as of PP09 12, 712.25 hrs

	Command, Information Centers and Staging Areas	**Total NOAA Staff:**
Area Command Post	ROBERT, LA	**10**
Unified Incident Cmd	HOUMA, LA	**31**
Unified Incident Cmd	MOBILE, AL	**11**
Unified Incident Cmd	ST. PETERSBURG, FL	**3**
Unified Incident Cmd	KEY WEST, FL	**0**
Unified Incident Cmd - Source Control	HOUSTON, TX	**0**
Staging Areas		
Venice, LA	Venice, LA	**3**
Pascagoula, MS	Pascagoula, MS	**10**
	TOTAL DEPLOYED NOAA STAFF:	***68***
	Miscellaneous/Various Locations:	35
	Total Deployed NOAA Staff:	***103***

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through 02 June 2010



Received(Date): Thu, 03 Jun 2010 10:20:16 -0400
From: "Lauren.B.Lugo" <Lauren.B.Lugo@noaa.gov>
Subject: cable
To: John Rapp <John.Rapp@noaa.gov>

Ensuring that U.S. produced seafood from the Gulf of Mexico continues to be safe for both domestic and international markets is of the utmost importance to the Government of the United States. Federal and state agencies responsible for seafood safety and certification are working together to achieve this goal.

The U.S. Department of Commerce's National Marine Fisheries Service operates a Seafood Inspection Program and is the recognized Competent Authority for seafood export certification when required.

Analytical and sensory methods that will be used to re-open fisheries are based on internationally accepted criteria.

Lauren B. Lugo
NOAA Fisheries Service
Seafood Inspection Program
[redacted]
fax: [redacted]

Received(Date): Thu, 03 Jun 2010 10:48:17 -0400
From: Margaret Spring <Margaret.Spring@noaa.gov>
Subject: Fw: Fwd: Fwd: FW: link
To: "'dwh.staff@noaa.gov'" <dwh.staff@noaa.gov>,"'Dave.Westerholm@noaa.gov'" <Dave.Westerholm@noaa.gov>,"'David.Kennedy@noaa.gov'" <David.Kennedy@noaa.gov>,"'Jen.Pizza@noaa.gov'" <Jen.Pizza@noaa.gov>,"'Shelby.Walker@noaa.gov'" <Shelby.Walker@noaa.gov>,"'Gabrielle.Dreyfus@noaa.gov'" <Gabrielle.Dreyfus@noaa.gov>
frank_parker.vcf

Live link to science conf at LSU

From: frank parker <frank.parker@noaa.gov>
To: HDQ PCO Contacts <PCO.Contacts@noaa.gov>; HDQ Policy Contacts <Policy.Contacts@noaa.gov>
Sent: Thu Jun 03 10:32:07 2010
Subject: Fwd: Fwd: FW: link

http://www.cnn.com/video/flashLive/live.html?stream=stream4

-------- Original Message --------

Subject: FW: link
Date: Thu, 03 Jun 2010 10:07:41 -0400
From: Staci Lewis <slewis@oceanleadership.org>
To: Parker, Frank <Frank.Parker@noaa.gov>

FYI

From: Staci Lewis
Sent: Thursday, June 03, 2010 9:07 AM
To: 'amrit.mehra@noaa.gov'
Subject: link

http://www.cnn.com/video/flashLive/live.html?stream=stream4

Staci Lewis
Policy Analyst
Consortium for Ocean Leadership

1201 New York Ave NW
4th Floor
Washington, DC 20005

Office. [redacted]
Email. slewis@oceanleadership.org

Frank Parker
Program Coordination Office
US Department of Commerce
National Oceanic and Atmospheric Administration

Rm 5811
1401 Constitution Ave NW
Washington, DC 20230

202.482.1075 (Work)
202.482.4116 (Fax)
301.602.5577 (Cell)

frank.parker@noaa.gov (Internet)

Formatted Name
Frank Parker

Name
Family: Parker
First: Frank
Middle:
Prefix:
Suffix:

Organization
US Department of Commerce
National Oceanic and Atmospheric Administration

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202.482.4116

Telephone Number (Cell)
301.602.5577

x-mozilla-html
TRUE

Version
2.1

Received(Date): Thu, 03 Jun 2010 11:29:17 -0400
From: Linda Belton <Linda.Belton@noaa.gov>
Subject: Fw: Thursday 10:00 a.m. IGA Coordination Call
To: "'dwh.staff@noaa.gov'" <dwh.staff@noaa.gov>
Alabama Gov Report 3JUN (final).pdf
Florida Gov Report 3JUN (final).pdf
Louisiana Gov Report 3JUN (final).pdf
Mississippi Gov Report 3JUN (final).pdf

These are the fact sheets that are being sent to Governors daily.

From: McGrath, Shaun L. <Shaun L. McGrath@who.eop.gov>
To: McGrath, Shaun L. <Shaun L. McGrath@who.eop.gov>; linda.belton@noaa.gov <linda.belton@noaa.gov>; Monica.Medina@noaa.gov <Monica.Medina@noaa.gov>; heather.smith1@dhs.gov <heather.smith1@dhs.gov>; Stephanie.Tennyson@dhs.gov <Stephanie.Tennyson@dhs.gov>; Pallone.Sarah@epamail.epa.gov <Pallone.Sarah@epamail.epa.gov>; Lori Faeth@ios.doi.gov <Lori Faeth@ios.doi.gov>; Juliette.Kayyem@dhs.gov <Juliette.Kayyem@dhs.gov>; smoilanen@who.eop.gov <smoilanen@who.eop.gov>; Mark.G.Moland@uscg.mil <Mark.G.Moland@uscg.mil>; gail.tate@dhs.gov <gail.tate@dhs.gov>; cmunoz@who.eop.gov <cmunoz@who.eop.gov>; William.R.Grawe@uscg.dhs.gov <William.R.Grawe@uscg.dhs.gov>; smcgrath@who.eop.gov <smcgrath@who.eop.gov>; dgnew@who.eop.gov <dgnew@who.eop.gov>; ckammerer@who.eop.gov <ckammerer@who.eop.gov>; McIntosh.David@epamail.epa.gov <McIntosh.David@epamail.epa.gov>; eryan@who.eop.gov <eryan@who.eop.gov>; jarrod.bernstein@dhs.gov <jarrod.bernstein@dhs.gov>; JCostanza@doc.gov <JCostanza@doc.gov>; jcarson@ceq.eop.gov <jcarson@ceq.eop.gov>; Kellyn.Blossom@dhs.gov <Kellyn.Blossom@dhs.gov>; WRamos@doc.gov <WRamos@doc.gov>; gnelson@who.eop.gov <gnelson@who.eop.gov>; john.gray@noaa.gov <john.gray@noaa.gov>; dan.jones@sba.gov <dan.jones@sba.gov>; paul.dioguardi@hhs.gov <paul.dioguardi@hhs.gov>; asalzman@who.eop.gov <asalzman@who.eop.gov>; Amanda.Botelho@HQ.DHS.GOV <Amanda.Botelho@HQ.DHS.GOV>; achhabra@who.eop.gov <achhabra@who.eop.gov>; mblock@who.eop.gov <mblock@who.eop.gov>; Jennifer.Yezak@osec.usda.gov <Jennifer.Yezak@osec.usda.gov>; Oster.Seth@epamail.epa.gov <Oster.Seth@epamail.epa.gov>; John.Berge@osec.usda.gov <John.Berge@osec.usda.gov>; Drew.Schneider@dhs.gov <Drew.Schneider@dhs.gov>; Bermejo.Elmy@dol.gov <Bermejo.Elmy@dol.gov>; joseph.loddo@sba.gov <joseph.loddo@sba.gov>; Solange.O.Hubble@uscg.dhs.gov <Solange.O.Hubble@uscg.dhs.gov>; mguernica@ceq.eop.gov <mguernica@ceq.eop.gov>; David.W.Murk@uscg.mil <David.W.Murk@uscg.mil>; Ver.Aaron@dol.gov <Ver.Aaron@dol.gov>; mboots@ceq.eop.gov <mboots@ceq.eop.gov>; Claudia.C.Gelzer@USCG.MIL <Claudia.C.Gelzer@USCG.MIL>; Miya.Chen@ed.gov <Miya.Chen@ed.gov>; Agnew, David P. <David P. Agnew@who.eop.gov>; Tracy.Wareing1@dhs.gov <Tracy.Wareing1@dhs.gov>; Lawrence.E.Greene@uscg.mil <Lawrence.E.Greene@uscg.mil>; Mark.G.Moland@uscg.mil <Mark.G.Moland@uscg.mil>; Lauren.Kidwell@hhs.gov <Lauren.Kidwell@hhs.gov>; Elizabeth.A.Watson@uscg.mil <Elizabeth.A.Watson@uscg.mil>; Todd.J.Offutt@uscg.mil <Todd.J.Offutt@uscg.mil>; Guernica, Georgina M. <Georgina M. Guernica@ceq.eop.gov>; Salzman, Amelia S. <Amelia S. Salzman@ceq.eop.gov>; Ryan, Evan M. <Evan M. Ryan@ovp.eop.gov>
Sent: Thu Jun 03 10:17:47 2010
Subject: RE: Thursday 10:00 a.m. IGA Coordination Call

From: McGrath, Shaun L.
Sent: Thursday, June 03, 2010 10:08 AM
To: McGrath, Shaun L.; 'linda.belton@noaa.gov'; 'Monica.Medina@noaa.gov'; 'heather.smith1@dhs.gov'; 'Stephanie.Tennyson@dhs.gov'; 'Pallone.Sarah@epamail.epa.gov'; 'Lori Faeth@ios.doi.gov'; 'Juliette.Kayyem@dhs.gov'; 'smoilanen@who.eop.gov'; 'Mark.G.Moland@uscg.mil'; 'gail.tate@dhs.gov'; 'cmunoz@who.eop.gov'; 'William.R.Grawe@uscg.dhs.gov'; 'smcgrath@who.eop.gov'; 'dgnew@who.eop.gov'; 'ckammerer@who.eop.gov'; 'McIntosh.David@epamail.epa.gov'; 'eryan@who.eop.gov'; 'jarrod.bernstein@dhs.gov'; 'JCostanza@doc.gov'; 'jcarson@ceq.eop.gov'; 'Kellyn.Blossom@dhs.gov'; 'WRamos@doc.gov'; 'gnelson@who.eop.gov'; 'john.gray@noaa.gov'; 'dan.jones@sba.gov'; 'paul.dioguardi@hhs.gov'; 'asalzman@who.eop.gov'; 'Amanda.Botelho@HQ.DHS.GOV'; 'achhabra@who.eop.gov'; 'mblock@who.eop.gov'; 'Jennifer.Yezak@osec.usda.gov'; 'Oster.Seth@epamail.epa.gov'; 'John.Berge@osec.usda.gov'; 'Drew.Schneider@dhs.gov'; 'Bermejo.Elmy@dol.gov'; 'joseph.loddo@sba.gov'; 'Solange.O.Hubble@uscg.dhs.gov'; 'mguernica@ceq.eop.gov'; 'David.W.Murk@uscg.mil'; 'Ver.Aaron@dol.gov'; 'mboots@ceq.eop.gov'; 'Claudia.C.Gelzer@USCG.MIL'; 'Miya.Chen@ed.gov'; Agnew, David P.; 'Tracy.Wareing1@dhs.gov'; 'Lawrence.E.Greene@uscg.mil'; 'Mark.G.Moland@uscg.mil'; 'Lauren.Kidwell@hhs.gov'; 'Elizabeth.A.Watson@uscg.mil'; 'Todd.J.Offutt@uscg.mil'; Guernica, Georgina M.; Salzman, Amelia S.; Ryan, Evan M.
Subject: RE: Thursday 10:00 a.m. IGA Coordination Call

Action items from Govs call:

Valerie – we are changing format of calls: 1) send out fact sheet prior to call; 2) Adm Allen as chief briefer

Allen – top cap failed. Now working on top hat. We will know this afternoon if we are successful on containment

Adm. Poullen – some of the boom from Europe – need to verify if compatible

Vessels of opportunity – We need to get numbers from BP on how many workers they have hired – locally and from outside. Need to get a breakdown of the technical skills for the different jobs, and direct locals to the appropriate jobs for them. VJ: 1st priority is safety; 2nd is hiring locals!. Riley said local vessels were creating a blockade against the Maine boats!! (Is this true) Riley said there was an article in local paper (Mobile?) about the hiring of locals. Jindal agreed strongly with VJ. They are having same problems in LA. We need to lean on BP. Jindal also mentioned 11,000 prisoner to release.

Jindal – thanks for decision on berms. Please lean on BP to start funding them one way or the other. Allen took it on as an action item

Jindal – claims process – BP still saying no denials, but there are many that are open after a month! Need info on the small businesses. Allen we will follow up. Riley also has examples. Will give info to Adm Watson today during their meeting.

Juliette – described flood insurance issues. She will be sending out written information. Jindal said it was very helpful info and will look forward to written materials to get to his insurance commissioner.

Boom report – don't call it UCCP -- ACP

From: McGrath, Shaun L.
Sent: Wednesday, June 02, 2010 7:22 PM
Subject: Thursday 10:00 a.m. IGA Coordination Call

Thursday, June 3

IGA Coordination Call – BP Deepwater Horizon Response

B6 Privacy / Pin: B6 Privacy #

10:00 a.m. EDT

Here is the draft agenda for the IGA coordination call tomorrow

- Report from IGA in the Gulf
- Discuss follow up to the June 3 Governors Call
- Preparation for June 4 Governors call

o Run through agenda and speakers

· Discuss follow up to the June 2 call with <u>Local Officials</u>

· Preparation for June 3 call with <u>Local Officials</u>

o Agendas and speakers

· Reports

o DHS

o EPA

o DoI

o Commerce/NOAA

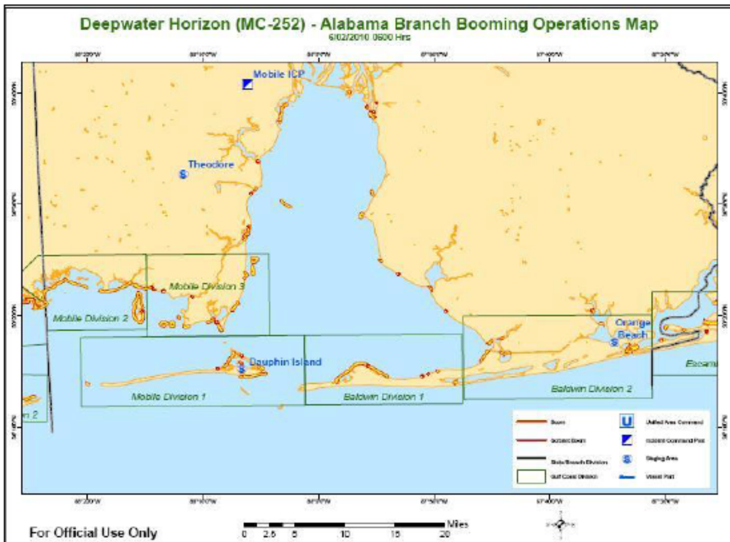
o USDA

o Labor

o SBA

o CEQ

o Other



SHORE OPERATIONS ALABAMA

National Incident Command Daily Situation Update

Prepared By: (MSTC Lisenby 3Jun10/0330)

Operational Activity (Last 24 Hour Period)

•Three barges are currently being fitted with frac tanks and converted to skimming barges to replace the three NOFI skimmers.
• Boom loaded to meet our pre-positioning plan covering Dauphin Island gulf side, Katrina Cut, Perdido Bay opening, and the points from Fort Morgan east.
• On shore cleanup crews will continue working in hot shot teams with ATVs along the entire gulf coast side of Dauphin Island.
• Mobile County laid 19,500 feet of boom from Barron Point to Bayou Coden this is the start of the estimated 52,000 feet needed to go around Mon Louis Point. 100 feet of replacement boom was placed in Mobile 1.
• Baldwin County: 5,200 feet of tier on booming was laid at Perdidio Pass. There was 1000 feet of replacement boom laid today in Baldwin County at AL-21.01 and AL-19.01.
•Skimming operations conducted at heavy oil pool area at Petit Bois and Dauphin Island.

Operational Activity (Next 24 hour period)

•Boom in Mobile & Baldwin Counties continue in full time maintenance status. Reports (via public and over flights) of displaced or damaged boom being responded to daily.
• Investigate a report of sheen southwest of Dauphin Island
• Boom loaded to meet our pre-positioning plan covering Dauphin Island gulf side, Katrina Cut, Perdido Bay opening, and the points from Fort Morgan east.
• Booming Perdido Bay will continue.
• On shore cleanup crews will continue working in hot shot teams with ATVs along the entire

Shoreline Impacts

County	Miles of Impacted Shoreline	Type of Impact	People Assigned	Estimated Clean Date	Wildlife Impact?
Mobile	0.46	Mousse/ Light	500*		No
Baldwin	11.2	Weathered Tar Balls (4)	4	Collected	No
		Tar Balls (1)			
		Oiled Bottles (7)			
TOTAL	11.66		504		

Resources

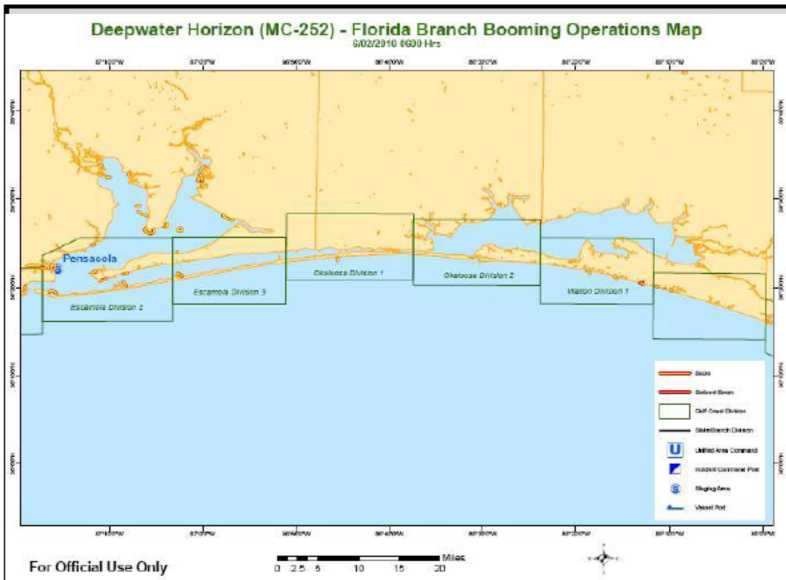
Boom Stats		Personnel Totals		Equipment	
UCCP Req	442,700	USCG	219	Skimmers	131
Boom Deployed	329,100	Natl Guard	282	Vessels	209
% Complete	83%	Contractors	3357	Small Boats	0
Add'l Boom Requested		BP	144	Fixed wing	3
Boom Staged	38,430	Other	570	Helo	3
Boom Ordered	105,250	Grand Total	4290	Barges	45
Gaps					
		SCAT	8		
		RAT	0		

Claims Summary

Number of Claims	Dollars Dispersed	Claims Denied	Claims Closed
7,096	$7,910,277.00	0	3028

* 500 contractors staged on Dauphin Island

Document ID: 0.7.19.1751.1



SHORE OPERATIONS - FLORIDA (PANHANDLE)

National Incident Command Daily Situation Update

Prepared By: (MSTC Lisenby 3Jun10/0330)

Operational Activity (Last 24 Hour Period)

- All Divisions continue to inspect, tend, maintain and reposition and/or repair boom throughout our division.
- 2 Crews in Pensacola AOR were dispatched with hand tools, sorbent materials and ATV's to survey shoreline from Navarre Beach into Eglin AFB in anticipation of potential oily landfall there. A Z-clearance was obtained and Eglin provided safe escort. No unanticipated oil was discovered.
- All Division crews are regularly touring their areas of responsibility, searching for oily impact.
- Pensacola crews worked at deploying redundant protection strategies at the entrance to Escambia Bay.
- Port St Joe crews prepared to receive a large shipment of sorbent boom.

Operational Activity (Next 24 hour period)

- All Divisions continue to inspect, tend, maintain and reposition and/or repair boom throughout our division.
- All Division crews are regularly touring their areas of responsibility, searching for oily impact.
- Skimming of pooled oil off of Florida Panhandle will commence.
- Developing plans to complete Florida ACP Tier I counties east of Port St Joe.

Shoreline Impacts

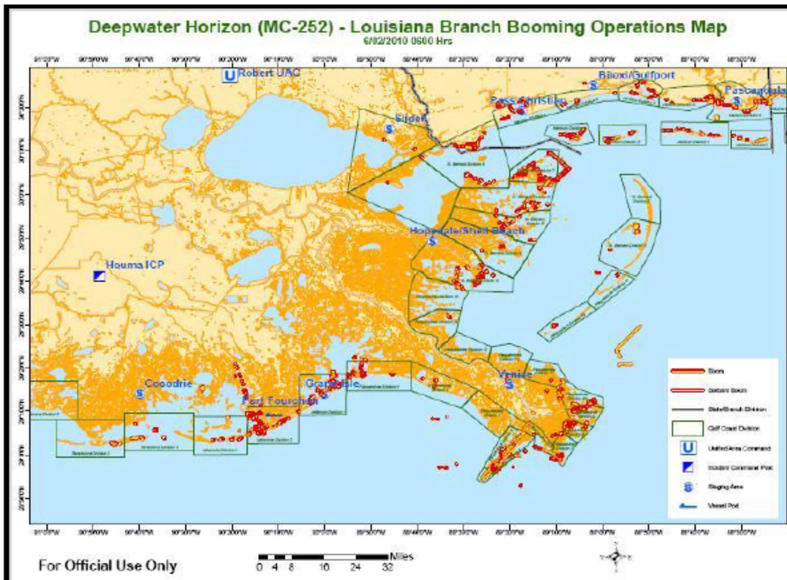
County	Miles of Impacted Shoreline	Type of Impact	People Assigned	Estimated Clean Date	Wildlife Impact?
Escambia	12	Weathered Tar Balls (8)	4	Collected	No
TOTAL	12		4		

Resources

Boom Stats		Personnel Totals		Equipment	
UCCP Req	148,475	USCG	33	Skimmers	11
Boom Deployed	134,250	Natl Guard	30	Vessels	0
% Complete	79%	Contractors	1072	Small Boats	119
Add'l Boom Requested		BP	9	Fixed wing	4
Boom Staged		Other		Helo	0
Boom Ordered		Grand Total	1144	Barges	4
Gaps					
		SCAT	4		
		RAT			

Claims Summary

Number of Claims	Dollars Dispersed	Claims Denied	Claims Closed
5,536	$3,882,844.00	0	1231



SHORE OPERATIONS - LOUISIANA

National Incident Command Daily Situation Update

Prepared By: CDR Scott Linsky 0100/03Jun10

Operational Acitivty (Last 24 Hour Period)

- Most operational activities suspended due to severe thunderstorms.
- All SCAT, RAT, Wildlife, Fishing Vessel Skimming were cancelled.
- Limited on shore operations occurred.
- Off Shore skimming proceeded when oil could be located without air support.
- Two in situ burns occurred at approximately 1100, but lasted less than 10 minutes each.
- Air support was limited but DASH 8 SLAR aircraft was able to provide partial coverage of the AOR.

Operational Activity (Next 24 hour period)

- The weather forecast for 3 JUN is very simliar to 2 JUN, with an 80% chance of severe thunderstorms.
- Weather permitting, operations will focus skimming and shoreline assessment between Southwest Pass and Port Fouchon where heavy oil was located just offshore.
- At the source, both skimming and in situ burning operation will

Shoreline Impacts

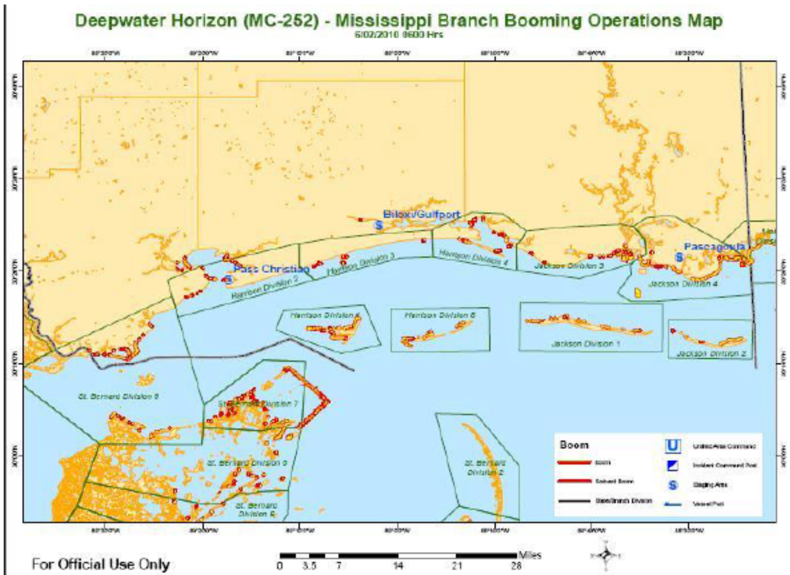
Parish	Miles of Impacted Shoreline	Type of Impact	People Assigned	Estimated Clean Date	
St. Tammany	0				
Orleans	0				
St. Bernard	8.53		73		
Plaquemines	10.18	sporadic oiling	332		
Jefferson	7.6		517		
Lafourche	0.8		290		
Terrebonne	0.48	minor oiling	66		
St. Mary	0		0		
Iberia	0.6		0		
Vermilion	0.7		0		
Cameron			0		
TOTAL	28.89		1278		

Resources

Boom Stats		Personnel Totals		Equipment	
UCCP Req	918,164	USCG	236	Skimmers	117
Boom Deployed	788,885	Natl Guard	1110	Vessels	1304
% Complete	86%	Contractors	6366	Small Boats	
Add'l Boom Requested	322,663	BP	202	Fixed wing	43
Boom Staged	141,672	Other	126	Helo	35
Boom Ordered		Volunteers	41	Barges	332
Gaps		Grand Total	8081		
		SCAT			
		RAT			

Claims Summary

Number of Claims	Dollars Dispersed	Claims Denied	Claims Closed
16,174	$25,198,288.00	0	7984



SHORE OPERATIONS - MISSISSIPPI

National Incident Command Daily Situation Update

Prepared By: (MSTC Lisenby 3Jun10/0330)

Operational Activity (Last 24 Hour Period)

- We have completed all 76 sensitive site protection strategies.
- Confirmed reports of tar balls impacting on the south coast of Petit Bois Island, Gulfport and Pascagoula.
- In addition to our daily over flights we have VOOs that also monitor our boom placement and feed us daily reports.
- Investigated tar ball sightings at Hancock and Harrison
- Continued to resource task forces in support of the strategic plan

Operational Activity (Next 24 hour period)

- Boom Maintenance
- In addition to our daily over flights we have VOOs that also monitor our boom placement and feed us daily reports.
- Investigate reports of oil, south of Ship Island

Shoreline Impacts

County	Miles of Impacted Shoreline	Type of Impact	People Assigned	Estimated Clean Date	Wildlife Impact?
Harrison	0.3	Mousse/Lt		TBD	No
Jackson	1.5	Mousse/Lt		TBD	No
TOTAL	1.8		0		

Resources

Boom Stats		Personnel Totals		Equipment	
UCCP Req	353,800	USCG	49	Skimmers	50
Boom Deployed	359,650	Natl Guard	68	Vessels	237
% Complete	101%	Contractors	1404	Small Boats	96
Add'l Boom Requested		BP	30	Fixed wing	1
Boom Staged	0	Other	216	Helo	0
Boom Ordered	0	Grand Total	1699	Barges	43
Gaps					
		SCAT	8		
		RAT	0		

Claims Summary

Number of Claims	Dollars Dispersed	Claims Denied	Claims Closed
3,879	$5,049,829.00	0	1883

Received(Date): Thu, 03 Jun 2010 11:51:17 -0400
From: Ralph.Lopez@noaa.gov
Subject: Fwd: NOAA & dispersants (from Mobile Press Register)
To: Lauren Lugo <Lauren.B.Lugo@noaa.gov>, John Rapp <John.Rapp@noaa.gov>,Walt Dickhoff <Walton.W.Dickhoff@noaa.gov>
Cc: Brian Pawlak <Brian.T.Pawlak@noaa.gov>,John Incardona <John.Incardona@noaa.gov>,Beth Lumsden <Beth.Lumsden@noaa.gov>, John Oliver <John.Oliver@noaa.gov>
Attachment

In today's newspaper piece on last night's Sea Grant community forum in Mobile an FDA rep is quoted as saying "NOAA is ensuring that dispersants aren't in the seafood making it (sic) to market." Is that accurate?

The weekly Gulf Outreach Call with about 400 environmental NGOs is tomorrow afternoon and I anticipate we may get asked about what we are doing regarding seafood safety in regards to both oil and dispersants. Do we have any cleared materials I can pass along to the NIC rep on that call, or uncleared drafts I can read up on in case I'm asked to respond to any questions? Thanks.

Received(Date): Thu, 03 Jun 2010 09:35:59 -0400
From: "Burkhardt III, William" <William.Burkhardt@fda.hhs.gov>
Subject: Mobile Press Register
To: Ralph.Lopez@noaa.gov

Link to Mobile Press Register Article
http://blog.al.com/live/2010/06/residents_oil_spill_concerns_q.html

In today's newspaper piece on last night's Sea Grant community forum in Mobile an FDA rep is quoted as saying "NOAA is ensuring that dispersants aren't in the seafood making it (sic) to market." Is that accurate?

The weekly Gulf Outreach Call with about 400 environmental NGOs is tomorrow afternoon and I anticipate we may get asked about what we are doing regarding seafood safety in regards to both oil and dispersants. Do we have any cleared materials I can pass along to the NIC rep on that call, or uncleared drafts I can read up on in case I'm asked to respond to any questions? Thanks.

Received(Date): Thu, 03 Jun 2010 12:08:59 -0400
From: Joe Inslee <Joe.Inslee@noaa.gov>
Subject: Notes from June 3, 11 AM NRT Call
To: NOAAHQ.Leadership@noaa.gov, Policy.Contacts@noaa.gov,PCO.Contacts@noaa.gov, dwh.staff@noaa.gov, David.Kennedy@noaa.gov,KSarri@doc.gov

Morning-
Below are notes from the June 3, 11 AM NRT call

FOR OFFICIAL USE ONLY

National Response Team Call
June 3, 2010
11:00 AM

The next NRT meeting is June 4 at 11 AM.

Situation Status:

- The attempt to cut the riser pipe with the diamond blade saw failed (it was pinched due to drilling pipe still in the riser).

-However the riser pipe was successfully cut with cutting shears. This left a rough cut and therefore a more loose fitting "Top Hat" containment structure will be put in place. They are trying to get this structure in place today.

- Skimming operations recovered approximately 15,000 bbls of an oil/water mix yesterday. Skimming operations continue today.

- Approximately 3,000 surface and 7,000 of sub-surface gallons of dispersants were applied yesterday.

- The President approved 6 emergency berms for Louisiana. The next step is get BP to fund this construction. Admiral Allen is meeting with BP today to discuss this.

Intergovernmental Affairs Update:

- Growing more and more busy as more State involvement is occurring.

- Trying to get better management of the data getting distributed out the States.

- Questions regarding boom resources continue.

Congressional Affairs

- Meeting with Appropriation staff went well yesterday. It does not look like the supplemental will pass by next week.

Legal Affairs

- Responding to lots of questions of regarding the types of liability BP is on the hook for.

- Continue to focus on fiscal issues.

- Yesterday the Center for Biological Diversity filed a lawsuit against the USCG under the Endangered Species Act regarding the use of dispersants.

Communications

- Admiral Allen gave a technical briefing this morning regarding the successful cut of the riser pipe.

- Media questions are very focused on the technical processes.

- The central message continues to be the important role science plays in this spill response.

Joe Inslee
Policy/Outreach Assistant
Assessment and Restoration Division
NOAA Office of Response and Restoration
1305 East West Highway SSMC 4, Rm. 10219
Silver Spring, MD 20910 Office [redacted] ext. 202
Cell [redacted]
Fax [redacted]

Received(Date): Fri, 04 Jun 2010 09:46:22 -0400
From: ICC Deputy <ICC.Deputy@noaa.gov>
Subject: June 3 ICC SITREP
To: Deepwater.HorizonDist@noaa.gov
June 3 slb SITREP.pdf

FOR OFFICIAL USE ONLY

CDR Weaver

--
ICC Deputy on Watch
ICC Main Number: [redacted]

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through 03 June 2010

- (NMFS) The contract vessel Beau Rivage is finished with all the trawl stations and is steaming back to Pascagoula. It is scheduled to arrive on Friday morning, June 4. Samples will be off-loaded and transferred to NSIL for analysis and the vessel will be prepared to go out again on Monday, June 7.
- (NMFS) The GORDON GUNTER will be returning to port Friday morning, June 4th. Dr. Lubchenco is currently scheduled to visit the GUNTER Friday afternoon, June 4th at approximately 1 p.m.
- (NOS) Gulf Coast Services Center staff, in collaboration with Sea Grant and other partners, facilitated town hall meetings in Biloxi and Mobile. Approximately 250 citizens attended each meeting. Local media coverage was extensive.
- (NOS) Direct Impact of Oil - The Gulf Coast Reserves are not seeing a direct ecological impact of the oil spill at this time, although the area from just west of Pascagoula, MS to the AL state line is now closed to recreational and commercial fishing, including the Grand Bay Mississippi NERR.
- Sampling
  - At the request of USFWS NRDA, Grand Bay NERR has expanded shoreline sampling to include presence of oiled birds.
  - Rookery Bay Florida NERR developed a West Coast NRDA sampling plan that has been reviewed and approved by the Florida trustee lead Lee Edmiston, and it has been forwarded to BP for review.
- Wildlife related
  - Grand Bay NERR will be used to assess bird damages by NRDA, and staff are planning on conducting additional point count surveys for marsh birds over the next week or two.

NOAA Ship *Gordon Gunter*

- GU received approval at 2100 on 02 June to conduct operations within 3NM of DWH site. Operating around the 3NM perimeter and an area to the SSW conducting acoustic profiles and CTD's.
- The AUV "GULPER" was deployed at 0600 Thursday morning and for an 11 hour sampling mission.
- Suspended sampling operations North of the DWH site at 1115 today due to strong odors that began to penetrate ship. These were the strongest fumes to date. Probably due to a combination of increased Southerly wind (15-18KTS) and greater releases from the well after cutting the pipe. No personnel have reported exposure symptoms however we required use of VOC respirators for any personnel on deck until we cleared the impacted area.
- Operational details as follows: CS reporting data/results summary through ICC.
  - 757nm of Acoustic Survey Completed
  - 24 XBT Casts
  - 29 CTD Casts
  - 3 MOCNESS Tows
  - 10 Sub Surface Neuston Tows
  - AUV Gulper Survey Hours: 38
  - SIPPER Survey Hours: 15
- Participating in daily calls with UC Environmental Unit (CAPT Pickett)
- 1900 Gallons used in the sixth 24 hrs. Total used 10,400. Remaining 3,700. On target for scheduled endurance until 04 June
- Equipment has only been "lighlty" oiled. HAZMAT controls working well.

- Requested VOC monitoring device via UC due to strong odors while operating in certain areas. Recommend future deployments of NOAA Ship's have these monitors.

<u>NOAA Ship Thomas Jefferson</u>

- Departed at 0600 EDT on June 3 for DWH “Western Sentry” project.

<u>R/V Gandy</u>

- Conducting Reef Fish Survey out of Panama City, FL

<u>R/V’s Caretta</u>

- Alongside Pascagoula prepping for TED Certification cruise. Scheduled to assist with spill response after 21 June.

<u>R/V HST</u>

- Alongside Pascagoula. Available. Suitable for coastal day trips.

<u>R/V Harold B</u>

- Coming out of shipyard this week. Scheduled to conduct trap/video surveys out of Panama City the remainder of the month. Vessel suitable for nearshore, day trips.

<u>F/V Beau Rivage</u>

- Concluding trawling in non-oiled areas to collect baseline samples for the National Seafood Inspection Laboratory. ETA Pascagoula 04 June.

<u>R/V Jack Fitz (a CSA International vessel)</u>

- Alongside in Port Fouchon

<u>R/V Pelican</u>

- Starting a 5-day cruise for FUGRO today

<u>Gliders</u>

- Info on Navy gliders:
  - NAVOCEANO seagliders SG135 and SG137 continue to survey the northern Gulf of Mexico in a suspected oil-free environment. The plan is to send the gliders in the direction of suspected oil locations today. We expect that the gliders will come into contact with oil within 6 to 10 hours of receiving their new waypoints.
  - The location and data plots (CDOM, Chlorophyll, Backscatter, salinity & temperature) from both gliders are ALL available on NAVOCEANO's public facing web: (https://oceanography.navy.mil/legacy/web/cgi-bin/search.pl/0/objects/0/7).

<u>Aircraft Operations Summary</u>

- Total flight time flown for 03 Jun 2010: 8.8 Hours
- Total flight time scheduled for 04 June : 9.0 Hours
- Total DWH/PEE flight time to date: 337.0 hrs
- P-3 loop current monitoring flight is planned for June 4, 2010.

Deepwater Horizon MC252
NOAA Incident Coordination Center
Situation Report For activities through 03 June 2010

Deepwater Response NOAA Financial Obligations as of June 3, 2010:

- ORF: $2.3M
- Reimbursable: $3.2M
- TOTAL: $5.5M

Personnel

- Employee billed hours as of PP09 12, 712.25 hrs

	Command, Information Centers and Staging Areas	**Total NOAA Staff:**
Area Command Post	ROBERT, LA	**11**
Unified Incident Cmd	HOUMA, LA	**28**
Unified Incident Cmd	MOBILE, AL	**10**
Unified Incident Cmd	ST. PETERSBURG, FL	**3**
Unified Incident Cmd	KEY WEST, FL	**0**
Unified Incident Cmd - Source Control	HOUSTON, TX	**0**
Staging Areas		
Venice, LA	Venice, LA	**2**
Pascagoula, MS	Pascagoula, MS	**11**
	TOTAL DEPLOYED NOAA STAFF:	***65***
	Miscellaneous/Various Locations:	26
	Total Deployed NOAA Staff:	***91***

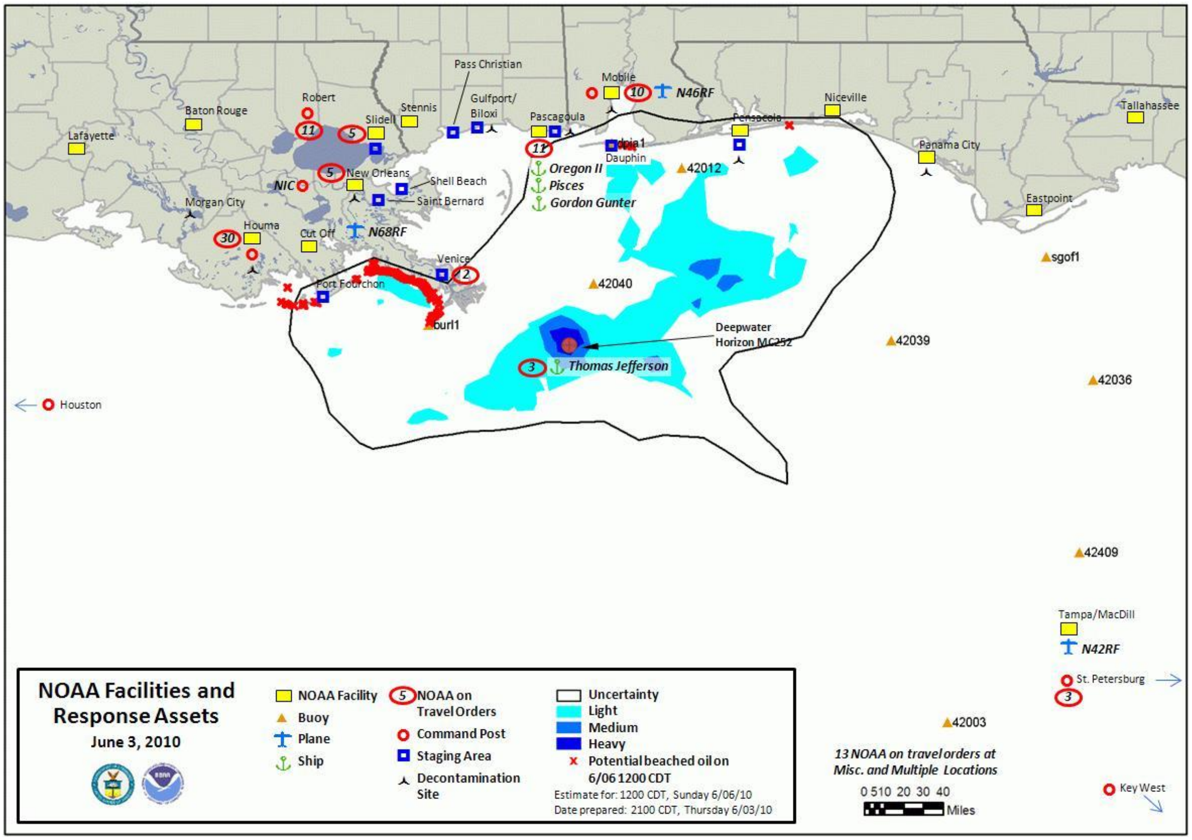
ICC Metrics for 03 JUNE 2010 as of 1800 EDT

- New Action Items: 6
- Closed: 162
- Open: 18
- Recurring: 26

Deepwater Horizon MC252

NOAA Incident Coordination Center

Situation Report For activities through 03 June 2010



Received(Date): Fri, 04 Jun 2010 11:18:04 -0400
From: John Oliver <John.Oliver@noaa.gov>
Subject: [Fwd: Today's closure change]
To: John Rapp <John.Rapp@noaa.gov>
John_Oliver.vcf

CLOSE HOLD

-------- Original Message --------

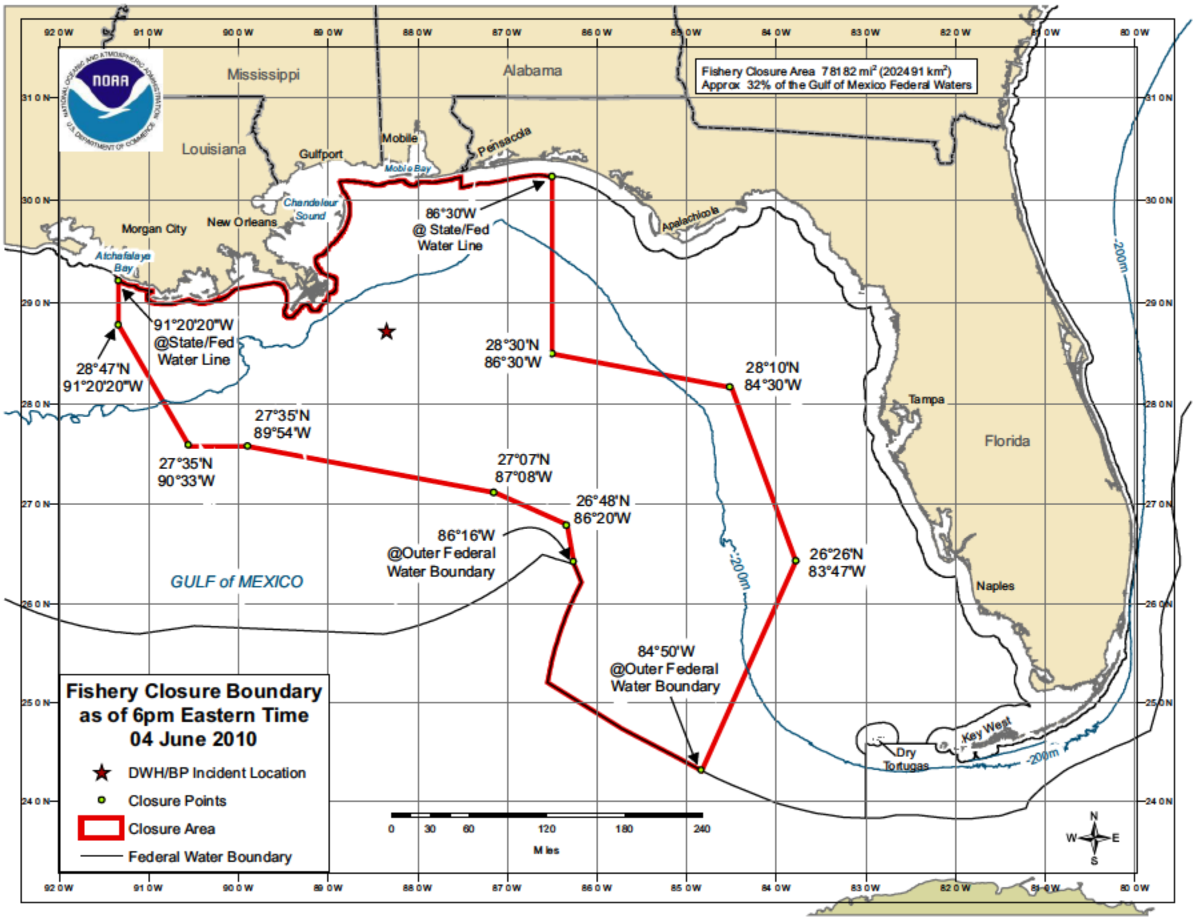
Subject: Today's closure change
Date: Fri, 04 Jun 2010 11:17:44 -0400
From: John Oliver <John.Oliver@noaa.gov>
To: Jane Lubchenco <Jane.Lubchenco@noaa.gov>, Monica Medina <Monica.Medina@noaa.gov>, Justin kenney <Justin.kenney@noaa.gov>, Amrit Mehra <Amrit.Mehra@noaa.gov>, Frank Parker <Frank.Parker@noaa.gov>, David Kennedy <David.Kennedy@noaa.gov>, Margaret Spring <Margaret.Spring@noaa.gov>

The net effect of today's action will decrease the closure area by 5% (from 37% to 32%), see below for details. This email has a small distribution, I will wait to send to the broader group with map. The information will be posted at noon on the web. jo

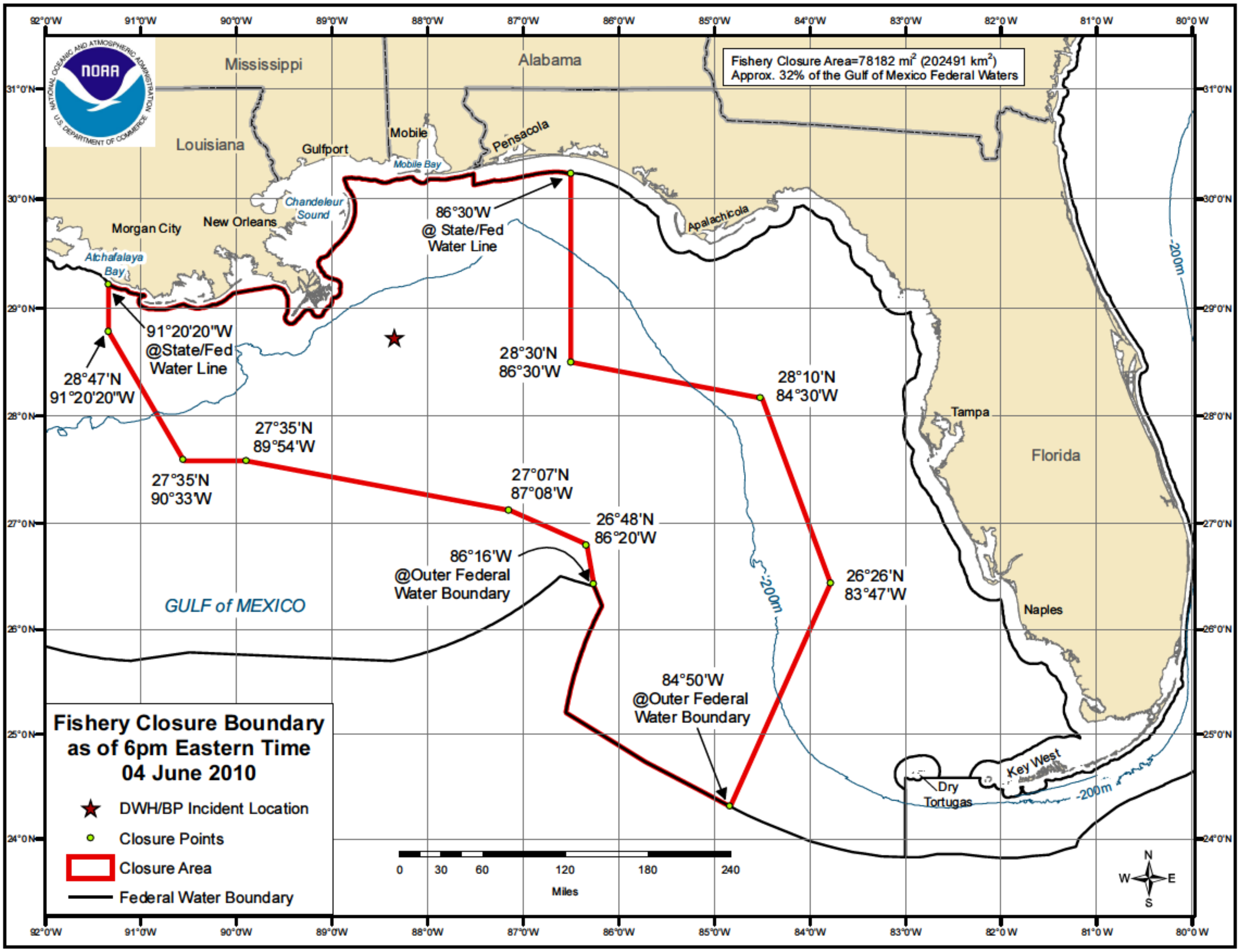
We are extending the northernmost closure boundary eastward along the federal state water line to waters off Choctawhatchee Bay, Florida, to encompass the projected movement of oil in that area over the next 72 hours. Also, we are retracting the southeastern closure boundary to open area inside the current boundary which was closed on June 2 as a precautionary measure based on trajectory data but was not impacted by oil.

The new closure measures 78,182 sq mi (202,491 sq km), or about 32% of the GOM EEZ, compared to the June 2 closure comprising 88,522 sq mi (229,270 sq km), or about 37% of the GOM EEZ. The new closure is reduced in size relative to the June 2 closure because the additional area we are closing to the north is smaller than the area we are reopening to the southeast.

The new closure map is attached. PLEASE DO NOT DISTRIBUTE UNTIL WE POST ONLINE. We intend to post the map (and supporting materials) at or before noon today. The new closure will become effective at 6 PM Eastern Time tonight.



Fishery Closure Area 78182 mi² (202491 km²)
Approx. 32% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Louisiana
Florida
Gulfport
Mobile
Mobile Bay
Pensacola
Chandeleur Sound
New Orleans
Morgan City
Atchafalaya Bay
Apalachicola
Tampa
Naples
Key West
Dry Tortugas
GULF of MEXICO
86°30'W @ State/Fed Water Line
91°20'20"W @State/Fed Water Line
28°47'N 91°20'20"W
28°30'N 86°30'W
28°10'N 84°30'W
27°35'N 89°54'W
27°35'N 90°33'W
27°07'N 87°08'W
26°48'N 86°20'W
86°16'W @Outer Federal Water Boundary
26°26'N 83°47'W
84°50'W @Outer Federal Water Boundary
-200m
Fishery Closure Boundary
as of 6pm Eastern Time
04 June 2010
DWH/BP Incident Location
Closure Points
Closure Area
Federal Water Boundary
0 30 60 120 180 240
Miles



Document ID: 0.7.19.2109.1

<CENTER><IMG SRC= http://www.nmfs.noaa.gov/images/usa2c.gif ></CENTER>

<CENTER><FONT SIZE="+1"><BOLD>John Oliver</BOLD></FONT></CENTER><CENTER>John.Oliver@noaa.gov</CENTER>

<CENTER>Deputy Assistant Administrator</CENTER><CENTER>National Marine Fisheries Service</CENTER><CENTER>(301)713-2239</CENTER>

Formatted Name

<CENTER><IMG SRC= http://www.nmfs.noaa.gov/images/usa2c.gif ></CENTER>

Name

Family: Oliver
First: John
Middle:
Prefix:
Suffix:

Organization

<CENTER>Deputy Assistant Administrator</CENTER><CENTER>National Marine Fisheries Service</CENTER><CENTER>(301)713-2239</CENTER>

Title

<CENTER><FONT SIZE="+1"><BOLD>John Oliver</BOLD></FONT></CENTER><CENTER>John.Oliver@noaa.gov</CENTER>

Version

2.1

Received(Date): Fri, 04 Jun 2010 16:58:08 -0400
From: Shelby Walker <Shelby.Walker@noaa.gov>
Subject: [Fwd: Re: Pelican/Weatherbird]
To: _HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>
Pelican-Weatherbird Research.docx

FYI-this was developed in response to an inquiry from NYT about the Pelican and Weatherbird data

-------- Original Message --------

Subject: Re: Pelican/Weatherbird
Date: Fri, 04 Jun 2010 16:47:11 -0400
From: Chris Vaccaro <Christopher.Vaccaro@noaa.gov>
To: Shelby Walker <Shelby.Walker@noaa.gov>
References: <4C0962E4.2070909@noaa.gov>

```
Attached.

Shelby Walker wrote:
> Hi Chris,
> Can you resend the final version that was forwarded?  I've lost track
> of it in my e mail and I need to forward that to DWH for Dr. L's
> briefing this afternoon.
> I'm also happy to meet with you regarding the timelines.
> Shelby
```

WEATHERBIRD CRUISE #2 - May 22-27 - Associated with Response activities, specially focused on assessing subsea dispersed petroleum from the top of the Loop Current to approximately 50-55 nm south of Mobile Bay.

-What sampling was taken? Focused on water sampling and on CTD (Conductivity/ Transport/Depth) and Fluorometry.

-What was found? WEATHERBIRD Scientists indicated observance of elevated fluorescence at 400m depth approx. 50-55 nm south of Mobile Bay. Additionally, scientists reported slicks at surface in various areas.

-Why are the results taking so long? Splits of water samples provided to NOAA on May 28th. Twenty-five samples were prioritized by WEATHERBIRD II scientists and are being analyzed by NOAA. In discussions with WEATHERBIRD II scientists, they are currently analyzing their splits. We anticipate a NOAA/USF joint data release next week (June 7-11).

WEATHERBIRD CRUISE #1 - May 5-17 - A NRDA Cruise

-What sampling was taken? Focused on Fisheries [baseline (tows - well away from well head)] and Plankton [baseline (well away from well head) and impact (near well head) using tows and shadow image particle profiling evaluation recorder (SIPPER)], with some surface water samples [baseline and impact] and sediment grabs [baseline])

-What was found? Historically, NRDA does not inform the response, and NRDA analysis occurs well after the response is ended (e.g., no real need to know baseline amounts prior to conducting the NRDA injury quantification which will compare baseline vs. post impacted conditions). Thus, NRDA samples are usually archived (or for water samples, they are extracted and archived).

As of about a week ago, NOAA agreed to make the NRDA data available to public. Many of these samples are now moving through the laboratory and will come out of the laboratory over the next few weeks. Our next step will be to submit these samples for 3rd party validation - a step which will take another two weeks. This is necessary as these data will form the basis of our legal case for damages against BP for injuries to the public's natural resources.

PELICAN CRUISE #2 - May 16-24, Unaffiliated with NRDA or Response (not NOAA supported; was supported by NSF)

-What sampling was taken? Pelican Scientists indicate water samples, fluorometry, CDT, etc. were taken during the cruise.

-What was found? Analysis ongoing.

PELICAN CRUISE #1 - May 2-16, Cruise unaffiliated with NRDA or Response (supported by NOAA through the National Institute for Undersea Science and Technology).

-What sampling was taken? Pelican Scientists indicate water samples, fluorometry, CDT, etc. were taken during the cruise.

-What was found? Based on Fluorometry, Pelican Scientists suggest identification of submerged petroleum plumes. NOAA requested splits of the water samples for petroleum chemistry. NOAA has not seen results from Pelican's analysis of their water samples. Fifteen (15) water samples provided to NOAA/LSU were received beyond the holding time, stored in plastic bottles, and at room temperature. For these reasons, under EPA guidance, the analytical results are considered invalid. Results from split samples run at LSU indicated no detectable hydrocarbons (in the parts per billion range). The caveat is that the manner in which the split samples were provided to NOAA/LSU invalidate these results based on EPA guidance.

-Why are the results taking so long? As stated above, NOAA results indicated no detectable hydrocarbons in the parts per billion range, but were considered invalid; Academic results pending.

Received(Date): Fri, 04 Jun 2010 17:06:56 -0400
From: "Jen.Pizza" <Jen.Pizza@noaa.gov>
Subject: DAILY DWH UPDATE 6.4.2010
To: DWH leadership <DWH.Leadership@noaa.gov>

DWH - NOAA ACTIVITIES – 6.4.2010 END OF THE DAY REPORT OUT

* What you need to know:

Press release coming out today > just been notified that AP is going to do a press release from a covo they had with scientist from the weathterbird that will suggest there is a confirmed oil plume. This release and the discussion leading up to it was not approved by Bill Hogarth. We have talked with Bill, he is standing by his joint PR from Monday but this AP release has already gone out.
We are currrently trying to contact Steve Murawski to corrdinate with Hogarth to move up their PR so that you may have that info available for your mtg with the POTUS on Monday.

TJ UPDATE:

· R/V Thomas Jefferson status
Deployed on June 6, expected return on June 11 (Galveston).
Current location-5nm south of well-head
Current operations-acoustic testing and deepwater sampling
Findings-Good returns on possible 1000m layer as well as potential vertical seeps.

-Operational details:
Thursday, 0600: Underway from port of New Orleans. Transit south west pass of the Mississippi River
·1400: Pilots depart and underway fire and abandon ship drills
·1415: Safety operations brief on the deployment/retrieval of fish and rosette sensors
·1430: Calibration of Cyclops 7 sensors in the fish and the rosette
·1500: Shallow water deployment of rosette followed by testing of moving vessel profiler cast and brake capabilities. Tests Sat.
·1900: Successful cast to 600m
·2000: Underway to conduct echosounder and cast work SW of the spill site, to continue excellent work by GU. Bravo Zulu GU!

Response Operations

· Oil still billows past Top hat #4 in video feeds, but ROVs closed 1 of 4 vents in the cap today and will close the other 3 over many hours to reduce hydrate formation and pressure changes

NIC Activities

· *ERMA team:* NIC ERMA team continues to handle high volume of requests from USCG.

Program presented to the Deputy Secretary of Homeland Security, who showed significant interest. The CG has requested a follow-up meeting with ERMA program staff in order to discuss a potential expansion of program. Now planning to support two ERMA staff in the NIC.

· *Sub Surface Oil Team:* Two one-pagers begun - one describing the role/charter of the NIC Subsurface Dispersed Oil Group, and one designed as a Best Practice document for the same group.

· *NMFS Communications:* NMFS is looking into how to more effectively communicate upcoming changes to the Fishery Closure area to the FOSC. This issue was raised on this afternoon's NRT call.

FISHERIES CLOSURES:

- The closed area was modified at noon and becomes effective at 6pm EST
  - The new closure measures 78,182 sq mi (202,491 sq km), or about 32% of the GOM EEZ, compared to the June 2 closure comprising 88,522 sq mi (229,270 sq km), or about 37% of the GOM EEZ.
  - The new closure is reduced in size relative to the June 2 closure because the additional area closed to the north is smaller than the area reopened to the southeast.
  - The map of the new closed area and a map with the new area and the June 2nd closure are attached.
- The 2010 Mississippi shrimp season opened at 6 am Thursday June 03, 2010, in territorial waters west of the East Biloxi ship channel.

SEAFOOD INSPECTION

- Beginning this weekend, all of the sensory assessors will return home from Pascagoula, MS except for a reduced crew of 4 who will assist with sample preparation and continue training State screeners next week. The full expert team is not needed at this time because no areas are under consideration for re-opening at this time. Therefore, we are giving the assessors a break to return home before they are needed in Pascagoula again.
- Next week is the second training session for State screeners.
- The complete daily Seafood Inspection report is attached.

MARINE MAMMAL AND TURTLE HEALTH AND STRANDING:

- 280 total sea turtles verified to date within the "designated spill area" (increase of 2 from June 2)
  - 255 stranded (increase of 2 from June 2)
  - 234 of the stranded were found dead (increase of 1 from June 2)
  - 21 of the stranded were found alive (increase of 1 from June 2)
  - 3 turtle released alive (increase of 2 from June 2)
  - 15 live turtles in rehabilitation (decrease of 1 from June 2)

- Increase of 1 previously stranded dolphin fully necropsied (no visible external or internal oil observed)
- The current designated spill area encompasses the coastline from the Texas/Louisiana border to Apalachicola (Franklin County), Florida. All stranded animals within this

geographic range are being examined following the oil spill response protocols.

- The directed turtle survey operating under Unified Command was on the water initially on June 3rd but conditions were not favorable and the operation was canceled. Operations are scheduled to resume today.
- The complete health and stranding report, turtle stranding map, and dolphin stranding map are attached.

COMMS UPDATE:

- Planning media rollout of ERMA/GeoPlatform.gov
- Finalizing talking points on seafood safety, with eye toward press rollout next week
- Held dockside press conference today for R/V Gordon Gunter return to Pascagoula, Miss.
- In various stages of responding to sensitive inquiries from NYTimes, WashPost, Denver Post & AP
- Correcting inaccuracies of 6/2 Huffington Post story
- Editing and clearing fact sheets on NRDA sampling summary, Long-term Movement of Oil
- Cleared two fact sheets on NRDA
- Scoping possible CNN Cooper embed with sea turtle stranding expert on de-oiling trip

NATURAL RESOURCE DAMAGE ASSESSMENT REPORT

Studies:

· Trustees have established 15 Resource Injury and Functional Groups (e.g. birds, shoreline, mammals and turtles, human use, submerged aquatic vegetation, etc.) to coordinate injury assessment activities at this time.

· Approximately 2,000 NRDA samples have been taken, breakdown regarding the amount (percentage of samples taken) is as follows;

o Water = 75%
- water samples (includes nearshore and offshore cruises, e.g., surface and sub-surface samples)

o Sediment = 15%
- sediment samples (nearshore and offshore)

o Tissue = 5%
- tissue samples (includes, but not limited to, bottlenose dolphin and oyster biopsies)

o Oil = 5%

- oil samples (source, surface, and shoreline, e.g., tarballs)

Between 15-20 field teams are currently active in the field on a daily basis conducting surveys and collecting samples

OFFSHORE CRUISES

· There are five research vessels currently conducting offshore NRDA studies in the Gulf of Mexico.

· **Gordon Gunter** – NOAA vessel

· **Thomas Jefferson** – NOAA vessel

· **Bunny Bordelon**

· **Jack Fitz**

· **Brooks McCall**

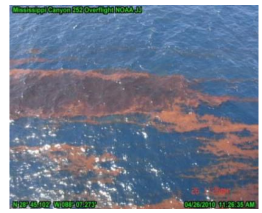
Notes Attached - DISPERSED OIL WORKSHOP OVERVIEW MAY 26 AND MAY 27, BATON ROUGE LOUISIANA –

SCIENCE UPDATE:

Bob and Steve had a productive meeting with EPA (Bob Perscapie) on overall Science Coordination.
ACTION:
1.Continuing to promote join assessment group

2. Government turtle experts are concerned about the impacts of the skimming efforts on sea turtle. USCG needs to be aware of ESA's.





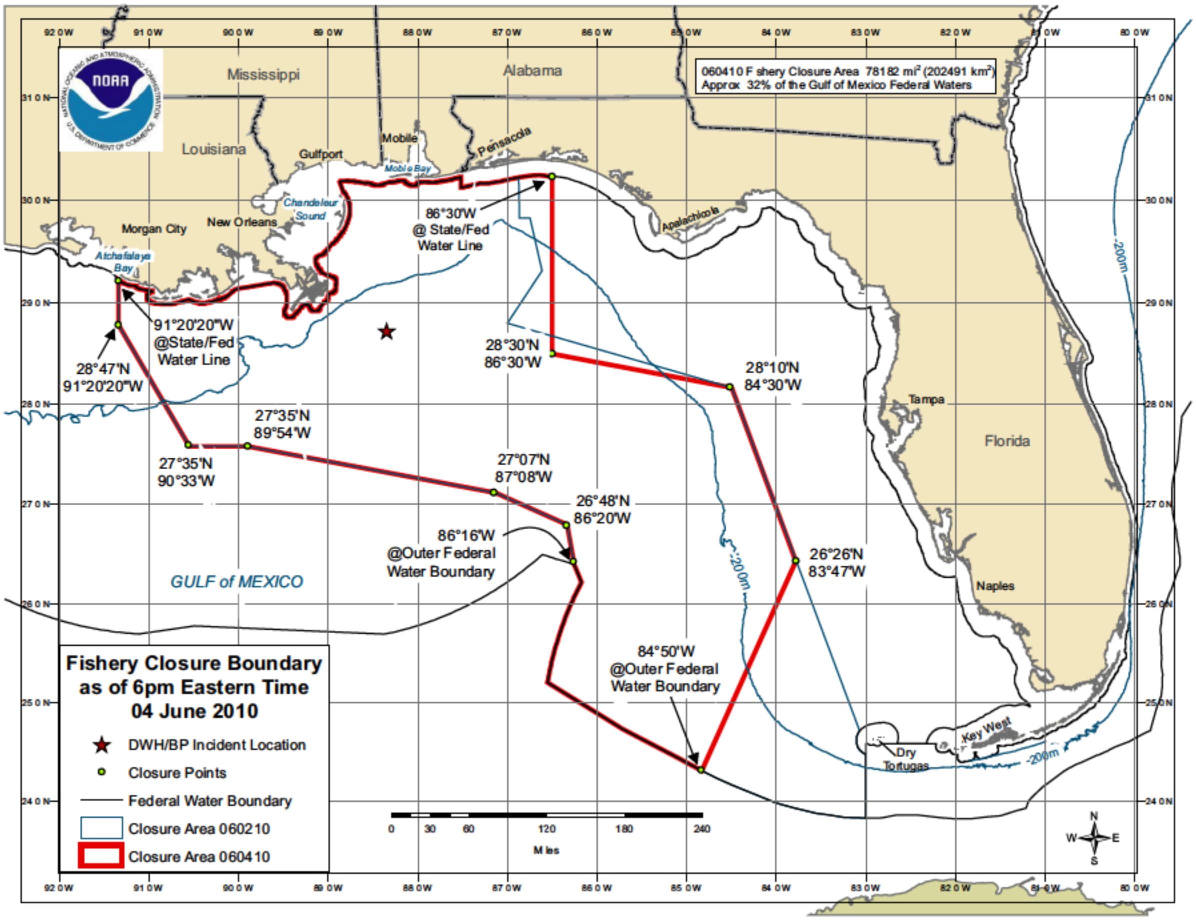

Deepwater Horizon Dispersant Use Meeting Report
May 26-27, 2010

Report Issued by: Coastal Response Research Center
University of New Hampshire
June 4, 2010

UNIVERSITY of NEW HAMPSHIRE

CoastalResponseResearchCenter

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE



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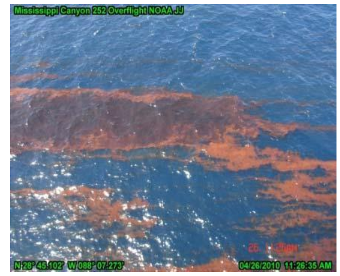


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FOREWORD

The Coastal Response Research Center, a partnership between the National Oceanic and Atmospheric Administration (NOAA) Office of Response and Restoration (ORR) and the University of New Hampshire (UNH), develops new approaches to spill response and restoration through research and synthesis of information. The Center's mission requires it to serve as a hub for research, development, and technology transfer to the oil spill community. The CRRC has a long history of overseeing research and development on the efficacy and effects of dispersed oil and convening dispersant related workshops with stakeholders from the oil spill community. At the request of NOAA, the center held a meeting on May 26 and 27 at the Lod Cook Alumni Center on the Louisiana State University (LSU) campus in Baton Rouge focusing on the use of dispersants in the Deepwater Horizon (DWH) incident in the Gulf of Mexico.

The meeting, titled "Deepwater Horizon Dispersant Use Meeting", was attended by over 50 scientists, engineers and spill response practitioners from numerous organizations, including: U.S. Coast Guard (USCG), Mineral Management Service (MMS), National Oceanic and Atmosphere Administration (NOAA), industry, state government, and academia. The ultimate goals of this meeting were to: (1) Provide input to the affected Regional Response Teams (RRTs) on the use of dispersants going forward in the DWH incident; and (2) Identify possible new monitoring protocols in the event of continuing aerial and subsurface dispersant application.

This report contains considerations on future use of dispersants and possible monitoring protocols for the RRTs along with the notes from the breakout groups, a participant list, the meeting agenda and Powerpoint presentations. I hope you find the input helpful and the discussion illuminating. If you have any comments, please contact me. The Center hopes that this report will be of use to the RRTs as they move forward with the Deepwater Horizon response and to the greater oil spill community and the nation.

Sincerely,

Nancy E. Kinner, Ph.D.
UNH Co-Director
Professor of Civil/Environmental Engineering

Acknowledgements

The Coastal Response Research Center gratefully acknowledges the CRRC authors of this report: Nancy E. Kinner, Joseph J. Cunningham III, Zachary E. Magdol, Heather R. Ballestero, and Tyler M. Crowe. The Center acknowledges the time and effort provided by the participants in the workshop, whose contributions have been synthesized into this report. In addition, the Center acknowledges the thoughtful input and comments received from the reviewers of the draft report: Craig Carroll (USEPA, RRT6); Richard Coffin (US-NRL); William Conner (NOAA, ORR); Charlie Henry (NOAA, ORR); Bruce Hollebone (Environment Canada); Robert Pond (USCG); Jeep Rice (NOAA, NMFS); Terry Wade (Texas A&M University). The Center also gratefully acknowledges the help of Professor Donald W. Davis (LSU Emeritus), David Nieland (LSU, Sea Grant) and the staff of the Lod Cook Hotel and Alumni Center at LSU for their help in making this meeting happen in less than 96 hours.

The following individuals helped plan this meeting: Carl Childs (NOAA OR&R); Tom Coolbaugh (Exxon Mobil); Dave Fritz (BP); Kurt Hansen (USCG, R&D Center); Charlie Henry (NOAA ORR); Bruce Hollebone (Environment Canada); Ken Lee (Fisheries and Oceans, Canada); and Al Venosa (USEPA). The Center staff for this meeting consisted of: Heather Ballestero; Joseph Corsello; Tyler Crowe; Joseph Cunningham; Michael Curry; Eric Doe; Nancy Kinner; Zachary Magdol; and Kathy Mandsager. The Center also gratefully acknowledges Bruce Hollebone and Nichole Rutherford (NOAA OR&R) for serving as group leaders.

Citation:
Coastal Response Research Center. 2010. Deepwater Horizon Dispersant Use Meeting Report. University of New Hampshire, Durham, NH, 21 pp and appendices.

Table of Contents

I. EXECUTIVE SUMMARY

Meeting participants developed the following input to the RRTs:

Input Regarding Overall DWH Response Methods

1. Chemical dispersants, mechanical recovery and *in situ* burning are components of an effective response to surface oil pollution.

2. Mechanical recovery is the preferred method of on water oil spill response because it removes the oil from the environment, but is not always effective due to environmental conditions (e.g., weather, waves).

3. No combination of response actions can fully contain oil or mitigate impacts from a spill the size and complexity of the DWH incident.

4. Toxicity must be considered when a decision is made to apply chemical dispersants.

5. The effects of using 2.5 MG of dispersants during the Ixtoc spill in 1979 (Jernelov and Linden, 1981) should be considered as part of the evaluation of the DWH incident.

Input Regarding Dispersant Use for the DWH Incident

6. It is the consensus of this group that up to this point, use of dispersants and the effects of dispersing oil into the water column has generally been less environmentally harmful than allowing the oil to migrate on the surface into the sensitive wetlands and near shore coastal habitats.

7. For the DWH spill, the RRTs should provide for a continual re-evaluation of tradeoff options going forward. Because of the magnitude of the DWH spill and with the expectation of prolonged dispersant application, the RRTs should consider commissioning a Consensus Ecological Risk Assessment, or equivalent, including use of existing temporal and spatial data on the resources at risk and using the most current environmental data.

8. Dispersed oil should be tracked over time and space in combination with 3-D modeling in order to inform future decisions on the use of dispersants for the DWH incident

9. There are short term laboratory and modeling studies which can be done to aid operational decision making (e.g., effect of high oil temp, high ambient pressure, and the presence of methane on dispersion effectiveness).

Input Regarding Monitoring Protocols for Dispersant Use

10. Monitoring protocols have been used for the DWH incident, modified as needed, and should be further adapted as noted in the specific sections of this report in the event of continuing aerial and subsurface dispersant application.

II. INTRODUCTION

At approximately 2200 hours on Tuesday, April 20, 2010, the U.S. Coast Guard (USCG) received a report that the mobile offshore drilling unit (MODU) Deepwater Horizon (DWH) located in the Mississippi Canyon lease site 252 (approximately 42 miles southeast of Venice, LA), had experienced an explosion and was on fire. The MODU sunk on April 24, scattering debris from the riser pipe across the ocean floor in ~5,000 feet of water. It became clear with a few days that the blowout preventer was not functional and oil was leaking into the water from more than one location on the broken riser.

Within hours of the incident, the USCG responded and began Search and Rescue (SAR) and environmental response operations. The release is relatively close to sensitive nearshore coastal habitats and wetlands, and prevailing winds drive the surface oil towards land. To prevent landfall of the oil, mechanical recovery techniques were used, including skimming and booming, as well as *in situ* burning. However, when poor weather conditions limited the effectiveness and suitability of mechanical recovery and burning, dispersants were applied to disperse surface oil and prevent landfall. In early May, responders began injecting dispersants at the source of the release in order to prevent oil from reaching the surface. These techniques have largely been successful, and have reduced the amount of oil reaching the nearshore. Consequently, dispersant use, primarily aerial (surface) application and in the oil plume as it exits the riser (deep ocean application), has become a major response tool as the release has continued unabated. The response was declared a Spill of National Significance (SONS) on April 29, 2010, and recent reports from the National Incident Command estimate that between 12,000 and 19,000 barrels of oil are released into the water every day, making the DWH incident the largest oil spill in U.S. history. More than 990,000 gallons of dispersant have been used thus far in the response, and with completion of relief wells scheduled for August, 2010, there is potential for significant further release of oil and application of dispersants.

In the event continued dispersant use is necessary throughout the summer, the Regional Response Teams (RRTs) expressed interest in late May in convening a meeting of scientists and practitioners to discuss dispersant use and provide input to the affected RRTs. This meeting, titled "Deepwater Horizon Dispersant Use Meeting" brought together approximately 50 participants to: (1) Provide input to the affected RRTs on the use of dispersants going forward in the DWH Incident; and (2) Identify possible new monitoring protocols in the event of continuing aerial and subsurface dispersant application. Four breakout groups were established that discussed: (1) Efficacy and effectiveness of surface and deep ocean use of dispersants; (2) Physical transport and chemical behavior of dispersants and dispersed oil; (3) Exposure pathways and biological effects resulting from deep ocean application of dispersants; and (4) Exposure pathways and biological effects resulting from surface application of dispersants.

III. MEETING ORGANIZATION AND STRUCTURE

The meeting, held at Louisiana State University on May 26 and 27, 2010, consisted of plenary sessions where invited speakers gave an overview of dispersant use in past oil spills, as well as an overview of the DWH incident and the response to date. Four breakout groups discussed key aspects of dispersant use in the DWH response: (1) Efficacy and effectiveness of surface and deep ocean dispersants use; (2) Physical transport and chemical behavior of dispersants and dispersed oil; (3) Exposure pathways and biological effects resulting from deep ocean application of dispersants; and (4) Exposure pathways and biological effects resulting from surface application of dispersants. Meeting participants were selected by a planning committee comprised of government and international partners with expertise in dispersants and oil spill response and research; meeting participants (Appendix B) represented a wide range of issue-related expertise and background, and included representatives from federal, state and foreign government agencies, as well as industry and academia.

Breakout questions (Appendix C) were developed by the Center staff and the planning committee. The breakout groups (Appendix D) developed input on continued use of dispersants for the DWH response, the risks/benefits of such use, and possible monitoring protocols going forward. In addition, they determined what information was needed to give the input, whether it was available for the DWH incident, or could be gleaned using information from past experience or the literature.

As a starting point, the following guidance was given to the breakout groups: (1) Surface dispersant operations have only been conducted in pre-approved zones (> 3miles offshore, >10 m water depth). Most dispersants have been applied 20-50 miles offshore where the water is much greater than 100 ft deep; (3) The footprint of surface dispersant application is relatively small; (4) The body of water in which the dispersants are applied is constantly changing; and (5) This meeting focused on oil effects and dispersants in general (no discussions of specific dispersants, just general composition types).

IV. MEETING RESULTS

A. Dispersant Efficacy and Effectiveness for Surface and Deep Ocean Application

Group A initially considered the efficacy and efficiency of surface and subsurface dispersant usage, however, on the second day of the workshop, the group was divided into two subgroups: Group A1 examined the efficacy and efficiency of deep ocean dispersant application, while Group A2 considered the efficacy and efficiency of surface dispersant application.

Group members included:

Group Lead: Joseph Cunningham, Coastal Response Research Center
Recorders: Joe Corsello* & Eric Doe, University of New Hampshire
Tom Coolbaugh*, Exxon Mobil
Craig Carroll#, U.S. EPA
Per Daling, SINTEF
J.T Ewing*, Texas General Land Office
Ben Fieldhouse, Environment Canada
Chantal Guenette*, Canadian Coast Guard
Ann Hayward Walker*, SEA Consulting
Lek Kadeli#, U.S. EPA
Paul Kepkay, Bedford Institute of Oceanography - Fisheries & Oceans Canada
Ed Levine*, NOAA
Zhengkai Li, Bedford Institute of Oceanography - Fisheries & Oceans Canada
Joe Mullin*, Minerals Management Service
Duane Newell*, U.S. EPA Contractor
Bob Pond, USCG
Kelly Reynolds*, ITOPF
Al Venosa, U.S. EPA

*Group Members assigned to Group A2 on Day 2
Group Members who were present for Day 1, but absent during Day 2

Information Required to Make Assessment:

- Spatial location of high, low, and non- effectiveness of dispersant
- Results of continuous water column monitoring, rather than discrete sampling events
- Extent of weathering from surface and subsurface oil
- GPS track routes to see if sampling boats are operating within the vicinity of aerial dispersant application tracks
- Properties of oil on the surface, including thickness and extent of weathering
- Properties of dispersant applied and untreated oil
- 3D visualization of plume
- Location, volume, and trends of plume
- Complete weathering profile of oil
- Accurate volumetric oil flow rate and dispersant application range
- Effect of temperature and pressure on droplet formation and dispersion

- Estimates of contact time and mixing energy
- Dispersability of emulsion after multiple applications of dispersant

Current State of Knowledge:

- Oil emulsion (> 15   20% water) is non-dispersible
- Plume is between 1100   1300 m deep moving SW direction
- DWH oil high in alkanes, and has a PAH composition similar to South Louisiana reference crude
- Lighter PAHs (< C15) are likely volatilizing
- Viscosity of emulsified oil is between 5500-8500 centistoke
- Emulsion may be destabilizing (50-60%)
- Primary detection method, C3 (fluorometer), only gives relative trends   does not accurately measure concentration of total oil or degree of dispersion

Knowledge Gaps:

- Ability of emulsions to be dispersed with multiple applications of dispersant
- Appropriate endpoint for dispersant application (i.e., how clean is clean?)
- Effectiveness and appropriateness of other dispersant applications (i.e., boat, subsurface, airplane, helicopter)
- Actual range of oil flowrates and composition (i.e., percentage oil, methane)
- Size of plume (volumetric)
- Diffusion of oil components from dispersed droplets into the water column (e.g., aliphatics, PAHs)
- Chemical composition of the plume (i.e., presence of oil, dispersant)
- Extent of surface and resurfacing of dispersed oil

Suggestions to Address Knowledge Gaps:

- Short and long term collection of chemical data (oil and dispersant concentration) at the surface and subsurface
- Measurement of methane concentrations and flowrate throughout the water column
- Analysis of natural vs chemically enhanced dispersion in the subsurface and surface

On day two, Group A was divided into two subgroups; Group A1 examined the efficacy and effects of surface water application, while A2 examined the efficacy and effects of deep ocean application.

Input for RRTs: Group A1   Surface Application:

1. Surface application of dispersants has been demonstrated to be effective for the DWH incident and should continue to be used.
2. The use of chemical dispersants is needed to augment other response options because of a combination of factors for the DWH incident (i.e., continuous, large volume release).
3. Winds and currents may move any oil on the surface toward sensitive wetlands
4. Limitations of mechanical containment and recovery, as well as *in situ* burning.

5. Weathered DWH oil may be dispersible. Further lab and field studies are needed to assess the efficacy and efficiency and optimal dispersant application (e.g., multiple dispersant applications).
6. Spotter airplanes are essential for good slick targeting for large scale aerial applications (e.g., C-130), so their use should be continued.
7. In order to most effectively use the assets available, the appropriate vessels or aircraft should be selected based on the size and location of the slick and condition of oil. Vessels and smaller aircraft should be used to treat smaller slicks and the weathered DWH oil because they can target more accurately and repeatedly. Larger aircraft should be used for larger fresh oil slicks offshore except in the exclusion zone around the source. A matrix of oil location, oil patch slicks size and condition, dispersant technique/dosage, visual guidance, requirements for success/confirmation has been developed by the dispersant assessment group in Houma incident command. This matrix should be reviewed by the RRTs.

Risks of Input for RRTs:

Dispersants will not be 100% effective. The matrix referenced above contains information to maximize the efficacy of dispersant application on different states of the DWH oil. Dispersants redistribute the oil from the surface to the water column which is a tradeoff decision to be made by the RRT.

Benefits of Input for the RRTs:

Dispersing the oil reduces surface slicks and shoreline oiling. The use of chemical dispersants enhances the natural dispersion process (e.g., the smaller droplet size enhances potential biodegradation). Dispersing the oil also reduces the amount of waste generated from mechanical containment and recovery, as well as shoreline cleanup.

Possible Monitoring Protocols for Surface Water Application:

1. There is a good correlation between Tier 1 SMART observations and Tier 2 field fluorometry data. There has been sufficient Tier 1 and 2 data collected for the DWH incident to indicate monitoring is not required for every sortie.
2. Going forward it is important to now focus on assessing the extent of the 3D area after multiple applications of dispersant at the surface. A sampling and monitoring plan to do this has been developed by the dispersant assessment group based in the Houma command center and initial implementation has begun. The RRT 6 should review this plan.

Input to RRTs: Group A2 Subsurface Application:

1. The subsurface dispersant dosage should be optimized to achieve a Dispersant to Oil Ratio (DOR) of 1:50. Because conditions are ideal (i.e., fresh, un-weathered oil) a lower ratio can be used, reducing the amount of dispersant required. The volume injected should be based on the minimum oil flowrate, however an accurate volumetric oil flowrate is required to ensure that the DOR is optimized.
2. If we assume a 15,000 bbls/day oil rate and a 1:50 DOR, then actual dispersant flowrate is roughly similar to the current application rate of 9 GPM.

3. To further optimize dispersant efficacy, the contact time between dispersant and oil should be maximized. Longer contact time ensures better mixing of oil and dispersant prior to being released into the water, and should result in better droplet formation.
4. Contact time can be increased by shifting the position of the application wand deeper into the riser, optimizing nozzle design on the application wand to increase fluid sheer, and increasing the temperature of the dispersant to lower viscosity.
5. Effectiveness should be validated by allowing for a short period of no dispersant application followed by a short time of dispersant usage to look for visual improvements in subsurface plume.

Risks of Input for RRTs:

Dispersants are never 100% effective. The flow rate of oil out of the damaged riser is not constant, and significant amounts of methane gas are being released. Because the effective DOR is a function of oil flow rate, changes in the oil flow rate may significantly impact the actual DOR. If the DOR is too low, dispersion may not be maximized, while if it is too high, dispersant will be unnecessarily added to the environment. Assumptions are based on knowledge at standard temperatures and pressures (STP), while conditions at the riser are significantly different. Group members suggested that the oil escaping the damaged riser may be in excess of 100°C, and it is unclear what effect this has on the dispersant, or the efficacy or effectiveness of droplet formation. These conditions may drastically alter fluid behavior. Finally, there is an opportunity cost of changes to application wand position and development and deployment of a new nozzle.

Benefits of Input for the RRTs:

When optimized, subsurface dispersant application may reduce or eliminate the need for surface dispersant application, and will reduce surfacing and resurfacing of oil. Optimized subsurface dispersant application will likely promote formation of smaller, more stable droplets of oil, theoretically allowing quicker biodegradation.

Possible Monitoring Protocols for Subsurface Application:

1. Measurement should be made on the surface and subsurface to detect dispersant and dispersed oil to gauge the effectiveness of subsurface dispersant application. Currently, no known technique exists for accurately measuring part per billion concentrations of dispersant in seawater, and novel applications of GC-MS/GC-FID or UVFS + LISST may be required.
2. Tier 1 (SMART) visual monitoring at the surface with quantification of oil with aerial remote sensing
3. Visual monitoring may be able to qualitatively demonstrate differences between dispersant application and no application (e.g., plume shape, color).

B. Physical Transport/ Chemical Behavior of Dispersed Oil

Group B was focused on the physical transport and chemical behavior of dispersed oil. While the initial goal was to look at these characteristics for chemically dispersed oil, the scope of the deepwater horizon incident required looking at both chemically and naturally dispersed oil.

Group members included:

Group Lead: Bruce Hollebone, Environment Canada
Recorder: Tyler Crowe, Coastal Response Research Center
Les Bender, Texas A&M
Mary Boatman, Minerals Management Service
Michel Boufadel, Temple University
Robert Carney, Louisiana State University
Jim Churnside, U.S. EPA
Greg Frost, U.S. EPA
Jerry Galt, Genwest
Buzz Martin, Texas General Land Office
Allan Mearns, NOAA
Scott Miles, Louisiana State University
Erin O'Riley, Minerals Management Service
Jim Staves, U.S. EPA

Information Required to Make an Assessment and Knowledge Gaps:

- Contact efficiency between dispersant and oil at the sea floor
- Release rate of oil and gas
- Dispersion efficiency at injection point on sea floor
- Mixing energy at injection point on sea floor
- Effects of increased pressure and temperature on dispersion efficiency
- Temperature of released oil
- Degree or rate of weathering of oil in rising plume (e.g., dissolution, vapor stripping)
- Emulsion formation and dispersion in the rise zone, under pressure
- Destabilization of emulsions as pressure decreases
- Biodegradation rate on droplets at pressure and at bottom temperature
- Sedimentation of dispersed oil from depth
- Biological uptake, particularly in demersal and benthic organisms
- Surface Langmuir circulation potential for mixing
- Surface advection rates versus oil discharge to determine buildup potential
- BTEX levels above oil slick
- Suppression of airborne VOCs when using dispersants
- Airborne concentrations of 2-butoxy ethanol from spring
- Atmospheric breakdown and toxicity of 2-butoxy ethanol and other products
- Improved NEBA for dispersant use

Current State of Knowledge:

- Surface models are effective and continuously improving
- SMART protocols are improving
- Increase of sampling at depth
- Well researched region (oceanographic and ecological studies)
- Well established baseline data
- Airborne application protocols are established

Suggestions to Address Knowledge Gaps:

- Review Norwegian experiments (Deep Spill, 2000)
- Review literature on IXTOC I
- Increase in remote sensing of the dispersed area (check for oil resurfacing)
- Use of smaller grid sizes or nested grids on models
- Increased offshore surface sampling independent of SMART at fixed stations in the operational zone
- Establishment of criteria for discontinuance of dispersant operations
- Further research on the contact efficiency between dispersant and oil at the subsurface injection point
- Better understanding of release rate and temperature of oil and gas
- Quantification of mixing energy at injection point
- Better coupling between offshore (ocean/pelagic) and onshore (estuarine or riverine) hydrodynamic models (LaGrangian vs. Eulerian)
- Laboratory investigation of effects of elevated pressure and temperature on dispersion efficiency at depth (e.g., study in pressure cells)

Input for RRTs:

1. Create an on-scene environmental review committee to advise SSCs that will be responsible for providing immediate operational and scientific advice, and aid in dispersant decisions. This committee should be comprised of government agencies and academia that meet regularly.
2. Clearly define geographic area/water volume of concern. This will improve estimates for scale of impact (1st order approximation). This is important for NEBA analysis, and is based on current application rates, and maximum concentrations in the water volume.
3. Establishment of a more comprehensive sampling and monitoring program to understand transport of oil on the surface and potential for long-term increases to TPH, TPAH, oxygen demand, or lowering of DO with continued dispersant application. This could be done by implementing off-shore water (first 10 m) monitoring stations (e.g., fixed stationary positions such as other drill rigs).

Risks of Input for RRTs:

Continued dispersant use trades shoreline impacts for water column impacts. This increases the uncertainty of the fate of the oil, and potentially increases the oil sedimentation rate on the bottom.

Benefits of Input for the RRTs:

Continued dispersant use reduces the threat distance, protects shorelines, likely increases the biodegradation rate of the oil, inhibits formation of emulsions, reduces waste management, and potentially reduces buildup of VOCs in the air.

Possible Monitoring Protocols for Subsurface Application:

1. Measure size and shape of the plume with and without subsurface injection of dispersant in order to have a better understanding of the efficacy. Sonar

monitoring of plume size and morphology (tilt) can be used; increases in plume size or longer "tail" of droplets suggest greater dispersion

2. Additional monitoring in the rising plume at a variety of depths to improve transport modeling and development of boundaries and constraints on estimates.
3. Additional subsurface monitoring of water temperature, particle size distribution, fluorescence monitoring of dispersant concentration, and total petroleum hydrocarbons (TPH) to define subsurface plume concentrations and boundaries.
4. Increase surface layer water quality monitoring (profile of upper 10 m) to address concerns of cumulative loading of water with oil and dispersant. Size of the monitoring zone will vary with advection and dispersant application. Should monitor for TPH, PAHs, dissolved oxygen, salinity, temperature, biological oxygen demand (BOD), VOA, and if feasible, surfactant monitoring and toxicity testing.
5. Further air monitoring of surface water quality zone to gain a better understanding of volatilization and risk to responders. Monitoring should include BTEX and VOC concentrations, and while COREXIT 9527 is being used, 2-butoxy ethanol.

C. Biological Effects of Dispersants on Deep Ocean Species

Group C discussed exposure pathways of dispersants applied to the subsurface and subsequent biological effects. Group members included:

Group Lead: Zachary Magdol, Coastal Response Research Center
Recorder: Mike Curry, Coastal Response Research Center
Adriana Bejarano, Research Planning Inc.
Richard Coffin, Naval Research Laboratory
William Conner, NOAA Office of Response and Restoration
Charlie Henry, NOAA, Scientific Support Coordinator for USCG District 8
Ken Lee, Environment Canada
Jeffrey Short, Oceana
Ron Tjeerdema, University of California

Information Required to make assessment:

- Receptor species/species at risk
- Identify species at risk including their migration, feeding habits, life histories, reproductive strategies/recruitment
- Dispersant effect on oxygen and other electron acceptor availability on key biogeochemical cycles in the deep water ecosystem
- Assess the maximum rates of dispersant application to balance treatment of the spill and a low environmental impact
- Determine the impact on nutrient recycling, general efficiency of food chain
- What is the particle size distribution as a function of depth, and if these changes affect key elemental absorption and feeding strategies
- Oil biodegradation rates, microbial community structure and ecosystem function in the presence and absence of the dispersant
- Evaluate the seasonal and spatial variation in the deep ocean oxygen demand in the presence and absence of the dispersant

- Scavenging particle interactions, oil-mineral aggregate formation at source and throughout water column
- Vertical and horizontal transport dynamics of deep water ocean currents for an overview of the oil and dispersant transport and dilution
- Unknown indirect effects (e.g., persistence) on the food chain and key elemental cycles
- Biogeochemical and habitat data about ecosystems near natural deep water petroleum seeps to evaluate the cycling rates and community structure
- Percent effectiveness of the seafloor dispersant application relative to the surface application
- Determine the changes in the petroleum layer through the water column with application of the dispersant
- Changes in microbial degradation due to selective metabolism from addition of dispersants (e.g., is there a preferred dispersant degradation that will pathway that will limit petroleum degradation?)
- Effectiveness of natural dispersion
- Knowing the downstream flux of oil residue from the spill to the seafloor to contribute to a net balance of the oil fate

Current State of Knowledge:

- Minerals Management Services, Gulf of Mexico deep water studies/reports: http://www.gomr.mms.gov/homepg/regulate/environ/deepenv.html
- Natural hydrocarbon seepage in the Gulf of Mexico approximately 40 million gallons per year
- Some knowledge and past studies on deep water species in the Gulf of Mexico
- Preliminary modeling
- Preliminary monitoring data (Fluorometry data, Particle size analysis, Temperature, Salinity, D.O., Hydrocarbon, Acute toxicity , Acoustic data, sonar, Genomics)
- None of the information listed above is considered "complete"

Knowledge Gaps:

- Preliminary models not validated
- Life history of benthic biota
- Migratory patterns and residence time of deep water species
- Microbial degradation rates on deep ocean hydrocarbon seeps
- Dispersant and dispersed oil byproducts
- Chronic toxicity of benthic biota
    - Comparison of bioaccumulation/bioavailability between different droplet sizes
    - Comparison of toxicity and environmental impact of natural vs chemically enhanced dispersed oil
- Species avoidance of oil

Suggestions to Address Knowledge Gaps:

- Formulation of biogeochemical rates with respect to fuel transport and sedimentation

- Early life stage studies, laboratory or cage studies
- Robust toxicity studies for deep water species
- Spatial and temporal variation in the ecosystem oxygen and alternate electron acceptor availability

Input for RRTs:

1. Dispersant risk assessment should consider volume of DWH incident relative to natural seepage
2. There is a net benefit to continued subsurface dispersant use and application should continue

Risks of Input for RRTs:

Dispersant use increases the extent of biological impacts to deep water pelagic and/or benthic organisms, including oxygen depletion, release of VOCs into the water column, and toxicity. This may lead to changes in the diversity, structure and function of the microbial community, leading to changes in trophic level dynamics and changes to key biogeochemical cycles.

Benefits of Input for the RRTs:

- Surface water column and beach impacts vs. vertical water column impacts
- Observed reduction in volatile organics at surface
- Enhances the interaction between oil and suspended particulate material
- Accelerated microbial degradation through increased bioavailability
- Rapid recovery of downward sulfate diffusion and upward methane diffusion related to shallow sediment geochemistry
- Based on current knowledge, subsurface dispersant use confines the aerial extent of impact
    - Current impact zone is less than 50 km radius
- Reduction in emulsified oil at the surface
- Reduction of phototoxic impacts

Possible Monitoring Protocols for Surface Water Application:

1. Robust deep ocean toxicity studies
    - Application of research done with acute toxicity on foraminifera, possibility of chronic studies (LC50, EC50)
    - Identify control areas, in terms of system ecology, physical ocean properties, and biogeochemical parameters
    - Cage studies in the plume
    - Identify surrogate/indicator species for impacts over a range of trophic levels
    - Identify key species of concern (migratory species)
    - Microbial genomics to survey changes in the community structure that changes key elemental cycles
    - Long term biological effects for resident species with baseline information
2. Biogeochemical monitoring
    - Petroleum degradation rates (C14 labels)

- Microbial production and function (3H thymidine/leucine and Genomics)
- Community diversity (16S RNA)
- Background parameters (DOC, POC, DIC, concentration and $\delta^{13}C$)
- Bioavailability of the oil as a function of particle size

3. Physical/chemical parameters
    - UV fluorometry (Including FIR)
    - Monitor the particle size distribution of the oil as function of space and time (LISST particle counters)
    - Current velocity (ADCP)
    - Chemical properties CTD (oxygen, salinity, pH, SPM)
    - Chemical and source properties of the oil as a function of space and time (GC-MS and IRMS)
    - Potential of acoustic monitoring (3.5 and 12 khz)

D. **Biological Effects of Dispersants on Surface Water Species**

Group D focused on the effects of surface dispersant application on species in the top ten meters of the water column. Group members included:

Group Lead: Nicholle Rutherford, NOAA
Recorder: Heather Ballestero, University of New Hampshire
Carys Mitchelmore, University of Maryland
Ralph Portier, Louisiana State University
Cynthia Steyer, USDA
Mace Barron, U.S. EPA
Les Burridge, St. Andrews Biological Stn, Fisheries and Oceans Canada
Simon Courtenay, Gulf Fisheries Centre, Fisheries and Oceans Canada
Bill Hawkins, Gulf Coast Research Laboratory, University of South Mississippi
Brian LeBlanc, Louisiana State University
Jeep Rice, NOAA
Doug Upton, MS DEQ
Terry Wade, Texas A&M University

Information Required to make assessment:

- Spatial location of oil, dispersants, and species
- The levels of concern need to be noted (e.g., sensitive species life stages, exposure pathways, LC50's oil and dispersant constituents)

Current State of Knowledge:

- The oil is being dispersed in the top ten meters of the water column from surface dispersant application (fluorescence methods)

Knowledge Gaps:

- Effectiveness of dispersant
- Long term effects of dispersant exposure (carcinogenicity)
- Dispersed oil effects in an estuarine/riverine/pelagic environment
- Bioavailability, bioaccumulation

Suggestions to Address Knowledge Gaps:

- Develop a clearinghouse to facilitate access to baseline data being collected

- Know dose of exposure, effects, species present and tradeoffs with habitat protection
- Understand differences between dispersed vs. non-dispersed oil

Input for RRTs: Effects of Dispersant in the top 10 M.

1. Surface application of dispersants is acceptable. Transferring the risk from the surface to the top 10 m is the lesser of the many evils.
2. Additional monitoring is required to better model where dispersed oil is going. Long term (monthly) monitoring is required at a minimum, and should be conducted in a grid formation inshore to open ocean. Passive samplers (i.e., SPME) should be used in selected areas, while a active water sampling program should be implemented to measure dispersant and dispersed oil, dissolved oxygen, and standard CTD + chlorophyll concentrations, as well as selected bioassays.

Possible Monitoring Protocols:

1. Monitor below 10 m
2. Monitor surface to bottom across a transect from the shore to source
3. Deploy semi-permeable membrane device (SPMD), passive sampling, or oysters
4. Monitor concentration and exposure time to get a better understanding of effective dose
5. Use state-of-the-art toxicity tests

E. Bibliography:

1. Adams, E.E. and S. A. Socolofsky. 2005. Review of Deep Oil Spill Modeling Activity Supported by the Deep Spill JIP and Offshore Operator's Committee. Final Report. http://www.mms.gov/tarprojects/377/Adams%20Review%204.pdf

2. Atlas, R.M.,"Fate of oil from two major oil spills: Role of microbial degradation in removing oil from the Amoco Cadiz and IXTOC I spills", (1981) Environment International, 5 (1), pp. 33-38.

3. Bedinger Jr., C.A., Nulton, C.P., "Analysis of environmental and tar samples from the nearshore South Texas area after oiling from the Ixtoc-1 blowout", (1982) Bulletin of Environmental Contamination and Toxicology, 28 (2), pp. 166-171.

4. Boehm, P.D., Flest, D.L., Mackay, D., Paterson, S.,"Physical-chemical weathering of petroleum hydrocarbons from the ixtoc I blowout: Chemical measurements and a weathering model", (1982) Environmental Science and Technology, 16 (8), pp. 498-505.

5. Boehm, P.D., Fiest, D.L., Kaplan, I., Mankiewicz, P., Lewbel, G.S., "A natural resources damage assessment study: The Ixtoc I blowout", 2005) 2005 International Oil Spill Conference, IOSC 2005, p. 5035.

6. Boehm, P.D., Fiest, D.L., Kaplan, I., Mankiewicz, P., Lewbel, G.S., "A natural resources damage assessment study: The Ixtoc I blowout", (2005) 2005 International Oil Spill Conference, IOSC 2005, p. 5035.

7. Boehm, P.D., Fiest, D.L., "Subsurface distributions of petroleum from an offshore well blowout. The Ixtoc I blowout, Bay of Campeche", (1982) Environmental Science and Technology, 16 (2), pp. 67-74.

8. Coastal Response Research Center (2006) Research & Development Needs For Making Decisions Regarding Dispersing Oil. http://www.crrc.unh.edu/dwg/dispersant_workshop_report-final.pdf

9. Cordes, C., Atkinson, L., Lee, R., Blanton, J.,"Pelagic tar off Georgia and Florida in relation to physical processes", (1980) Marine Pollution Bulletin, 11 (11), pp. 315-317.

10. Delikat, Donald S., "IXTOC I OIL SPILL & ATLANTIC RIDLEY TURTLE SURVIVAL.", (1980) Proceedings of SOUTHEASTCON Region 3 Conference, 1, pp. 312-319.

11. DeepSpill 2000: Johansen, Ø., Rye, H., Cooper, C. "DeepSpill-Field study of a simulated oil and gas blowout in deep water", (2003) Spill Science and Technology Bulletin, 8 (5-6), pp. 433-443.

12. Haegh, T., Rossemyr, L.I., "A comparison of weathering processes of oil from the Bravo and Ixtoc blowouts.", (1980) Proc. twelfth annual offshore technology conference, Houston, Texas, May 1980, pp. 237-244.

13. Haegh, Thor, Rossemyr, Leif I., "COMPARISON OF WEATHERING PROCESSES OF OIL FROM THE BRAVO AND THE IXTOC BLOWOUTS.", (1981) Proceedings of the Annual Offshore Technology Conference, 1, pp. 237-244

14. Hall, R.J., Belisle, A.A., Sileo, L., "Residues of petroleum hydrocarbons in tissues of sea turtles exposed to the Ixtoc I oil spill.", (1983) Journal of wildlife diseases, 19 (2), pp. 106-109.

15. Jernelov, A., Linden, O., "Ixtoc I: A case study of the world's largest oil spill", (1981) Ambio, 10 (6), pp. 299-306.

16. Johansen, O., et al. 2001. Deep Spill JIP Experimental Discharges of Gas and Oil at Helland Hansen June 2000. Final Technical Report http://www.mms.gov/tarprojects/377/DeepSpill%20Final%20Report.pdf

17. Johansen, O., et al. 2001. Deep Spill JIP Experimental Discharges of Gas and Oil at Helland Hansen June 2000. Final Cruise Report. http://www.mms.gov/tarprojects/377/DeepSpill%20Cruise%20Report.pdf

18. Johansen, O., et al. 2001. ROV Sonar and Pictures from Project "Deep Spill" - June 2000. Final Data Report. http://www.mms.gov/tarprojects/377/DeepSpill%20ROV%20Report.pdf

19. Kalke, R.D., Duke, T.A., Flint, R.W., "Weathered IXTOC I oil effects on estuarine benthos", (1982) Estuarine, Coastal and Shelf Science, 15 (1), pp. 75-84.

20. Linton, T.L., Koons, C.B., "Oil dispersant field evaluation. Ixtoc 1 blowout, Bay of Campeche, Mexico", (1983) Oil and Petrochemical Pollution, 1 (3), pp. 183-188.

21. Lizarraga-Partida, M.L., Rodriguez-Santiago, H., Romero-Jarero, J.M., "Effects of the Ixtoc I blowout on heterotrophic bacteria", (1982) Marine Pollution Bulletin, 13 (2), pp. 67-70.

22. Macko, S.A., Winters, J.K., Parker, P.L.,"Gulf of Mexico dissolved hydrocarbons associated with the IXTOC I mousse", (1982) Marine Pollution Bulletin, 13 (5), pp. 174-177

23. Masutani, S.M., Adams, E., 2001 Study of Multi-Phase Plumes with Application to Deep Ocean Oil Spills, Hawaii Natural Energy Institute, University of Hawaii, http://www.mms.gov/tarprojects/377/UH MIT Final 2001.pdf

24. Patton, J.S., Rigler, M.W., Boehm, P.D., Fiest, D.L.,"Ixtoc 1 oil spill: Flaking of surface mousse in the Gulf of Mexico", (1981) Nature, 290 (5803), pp. 235-238.

25. Slade, G.J., "Effect of Ixtoc I crude oil and Corexit 9527 dispersant on spot (Leiostomus xanthurus) egg mortality", (1982) Bulletin of Environmental Contamination and Toxicology, 29 (5), pp. 525-530.

26. Waldichuk, M.,"Retrospect of the Ixtoc I blowout", (1980) Marine Pollution Bulletin, 11 (7), pp. 184-186.

APPENDIX A

DEEPWATER HORIZON DISPERSANTS MEETING
May 26 – 27, 2010

Cook Center
Louisiana State University, Baton Rouge, LA

AGENDA

Tuesday, May 25		
	Arrival and Check-In	

Wednesday, May 26		
8:00	Continental Breakfast	
8:30	Welcome and Introductions	**Nancy E. Kinner, UNH Co-Director: Coastal Response Research Center**
		David Westerholm, Director: Office of Response & Restoration: National Oceanic and Atmospheric Administration **James Hanzalik, USCG; RRT 6** **Craig Carroll, EPA; RRT 6**
8:45	Background and Meeting Goals Workshop Structure, Logistics & Outcomes	**Nancy E. Kinner, CRRC**
9:00	Participant Introductions	
10:00	Break	
10:15	Plenary Session: Setting the Stage	
	Deepwater Horizon Spill Overview *Dispersant application for DWH spill (aerial and subsurface application)*	**Charlie Henry, NOAA SSC**
	Dispersant use in previous spill responses	**Kelly Reynolds, International Tanker Operators Pollution Fund (ITOPF)**
	Field evaluation of alternative dispersants	**Tom Coolbaugh: Exxon Mobil**
	Monitoring dispersant efficacy	**Ken Lee, Paul Kepkey, Zhangkai Li:: Bedford Institute of Oceanography**
12:15	**Lunch**	
1:00	**Commissioning of Groups** **Discussion of Common Starting Points**	**Nancy E. Kinner, CRRC** **Charlie Henry, NOAA**

DEEPWATER HORIZON DISPERSANTS MEETING
May 26 – 27, 2010

Wednesday , May 26		
1:15	Breakout Session I	
	Group A: Dispersant efficacy and effectiveness	**Leader: Joe Cunningham, CRRC**
	Group B: Physical Transport/ Chemical Behavior of dispersed oil	**Leader: Bruce Hollebone, Environment Canada**
	Group C: Biological effects of dispersants on deep ocean species	**Leader: Zachary Magdol, CRRC**
	Group D: Biological effects of dispersants on surface water species	**Leader: Nicolle Rutherford, NOAA OR&R**
3:15	Break	
4:15	Plenary Session: Group Reports	
5:15	Wrap Up	**Nancy E. Kinner, CRRC**
5:30	**Adjourn**	

Thursday, May 27		
8:00	Continental Breakfast	
8:20	Overview and Review/Recalibrate	Nancy Kinner
8:30	Breakout Session II	
	Group A1: Dispersant efficacy and effectiveness: Deep Ocean Application	**Leader: Joe Cunningham, CRRC**
	Group A2: Dispersant efficacy and effectiveness: Surface Application	**Leader: Nancy E. Kinner, CRRC**
	Group B: Physical Transport/ Chemical Behavior of dispersed oil	**Leader: Bruce Hollebone, Environment Canada**
	Group C: Biological effects of dispersants on deep ocean species	**Leader: Zachary Magdol, CRRC**
	Group D: Biological effects of dispersants on surface water species	**Leader: Nicolle Rutherford, NOAA OR&R**
10:00	Break (as necessary)	
11:15	Plenary Session: Breakout Group Reports	
12:15	Lunch	
1:00	Plenary Session: Development of Input and Protocols for RRTs and Next Steps	**Nancy E. Kinner, CRRC**
4:30	**Adjourn**	

APPENDIX B

NAME		AFFILIATION
Mace	Barron	U.S. EPA
Adriana	Bejarano	Research Planning, Inc
Les	Bender	Texas A&M
Marie	Benkinney	Exponent
Mary	Boatman	U.S. Minerals Management Service
Michel	Boufadel	Temple University
Les	Burridge	St. Andrews Biological Stn, Fisheries and Oceans Canada
Robert	Carney	Louisiana State University
Craig	Carroll	EPA, RRT 6
Jim	Churnside	NOAA
Richard	Coffin	Naval Research Laboratory
William	Conner	NOAA, ORR, ERD
Tom	Coolbaugh	ExxonMobil
Simon	Courtenay	Gulf Fisheries Centre, Fisheries and Oceans Canada
Per	Daling	SINTEF
Ronald	DeLaune	Louisiana State University
Christopher	D'Elia	Dean, School of Coast and Environment, LSU
J.T.	Ewing	Texas General Land Office
Ben	Fieldhouse	Environment Canada
Greg	Frost	NOAA
Jerry	Galt	NOAA, Genwest
Judy	Gray	NOAA
Christopher	Green	Louisiana State University
Chantal	Guenette	Canadian Coast Guard
James	Hanzalik	USCG, RRT6
Bill	Hawkins	Gulf Coast Research Laboratory, USM
Ann	Hayward Walker	SEA Consulting
George	Henderson	FL Fish & Wildlife
Charlie	Henry	NOAA, ORR, SSC
Bruce	Hollebone	Environment Canada
Lek	Kadeli	U.S. Environmental Protection Agency (ORD)
Paul	Kepkay	Bedford Institute of Oceanography - Fisheries & Oceans Canada
Nancy	Kinner	Coastal Response Research Center
Brian	LeBlanc	Louisiana State University
Ken	Lee	Bedford Institute of Oceanography
Ed	Levine	NOAA, ORR, SSC
Zhengkai	Li	Bedford Institute of Oceanography - Fisheries & Oceans Canada
Buzz	Martin	Texas General Land Office
Alan	Mearns	NOAA, ERD
Scott	Miles	Louisiana State University
Carys	Mitchelmore	University of Maryland, CES
Joe	Mullin	US Minerals Management Service
Tim	Nedwed	ExxonMobil
Duane	Newell	U.S. Environmental Protection Agency
John Andrews	Nyman	Louisiana State University
Erin	O'Reilly	U.S. Minerals Management Service, New Orleans
Christopher	Piehler	LA DEQ
Bob	Pond	U.S. Coast Guard
Ralph	Portier	Louisiana State University
Kelly	Reynolds	ITOPF
Jeep	Rice	NOAA, Auk Bay NMFS lab
Nicolle	Rutherford	NOAA, ERD
Jeffrey	Short	Oceana
Gus	Stacy	LA Oil Spill Coordinators Office (LOSCO)
Jim	Staves	U.S. Environmental Protection Agency
Cynthia	Steyer	USDA NRCS
Ron	Tjeerdema	University of California
Kenneth	Trudel	SL Ross
Doug	Upton	Mississippi DEQ
Albert	Venosa	U.S. Environmental Protection Agency
Terry	Wade	Texas A&M University
Dave	Westerholm	NOAA, ORR

COASTAL RESPONSE RESEARCH CENTER STAFF:	
Joseph	Cunningham
Joe	Corsello
Heather	Ballestero
Kathy	Mandsager
Tyler	Crowe
Zachary	Magdol
Eric	Doe
Mike	Curry
Beth	Potier

APPENDIX C

Breakout Sessions

Overarching Goals:

1. **Provide specific recommendations to the Region 4 and Region 6 Regional Response Teams (RRT) on the advisability of continuing the current level of dispersant operations, including changes in dispersant use and application methods for the spill.**
2. **Identify possible monitoring protocols in the event of continuing aerial and subsurface dispersant application.**

Breakout Session I: Wednesday afternoon

1. What do we need to know in order to make recommendations regarding dispersant operations and to identify possible monitoring protocols?
2. What is the current state of knowledge regarding the DWH spill?
3. What are the gaps in our knowledge or information?
   a. Can these gaps be addressed using information from past experience and/or the literature?
   b. If not, what information should be collected in the short and long term to support these recommendations?

Breakout Session II: Thursday morning

1. Develop specific recommendations for aerial and subsurface dispersant use if the DWH release continues.
   a. What are the tradeoffs (risks/benefits) associated with these recommendations?
2. Identify possible monitoring protocols in the event of continuing dispersant use.

APPENDIX D

Breakout Groups

Group A:Efficacy and Effectiveness	Group B: Physical Transport and Chemical Behavior
Room: Abell Room	**Room: Anderson Room**
Group Lead: Joe Cunningham *Recorders: Joe Corsello + Eric Doe* Tom Coolbaugh Craig Carroll Per Daling J.T Ewing Ben Fieldhouse Chantal Guenette Ann Hayward Walker Lek Kadeli Paul Kepkay Ed Levine Zhengkai Li Joe Mullin Duane Newell Bob Pond Kelly Reynolds Al Venosa	Group Lead: Bruce Hollebone *Recorder: Tyler Crowe* Les Bender Mary Boatman Michel Boufadel Jim Churnside Robert Carney Greg Frost Jerry Galt Buzz Martin Allan Mearns Scott Miles Erin O'Reilly Jim Staves

Group C: Biological Effects: Deep Ocean	Group D: Exposure and Effects: Non-commercial
Room: Shelton Room	**Room: Cook Room**
Group Lead: Zachary Magdol *Recorder: Mike Curry* Adriana Bejarano Richard Coffin Bill Conner Charlie Henry Ken Lee Jeff Short Ron Tjeerdema	Group Lead: Nicholle Rutherford *Recorder: Heather Ballestero* Carys Mitchelmore Ralph Portier Cynthia Steyer Mace Barron Les Burridge Simon Courtenay Bill Hawkins Brian LeBlanc Jeep Rice Doug Upton Terry Wade

APPENDIX E

RECORDER NOTES – GROUP A1 – MAY 26, 2010

Breakout Session I: Wednesday afternoon

1. What do we need to know in order to give input regarding dispersant operations and to identify possible monitoring protocols?

Way for oil to be dispersed
Effectiveness of dispersants – surface and subsea
Fluorometer use – indecisive
Where effectiveness high and low
Continued use good for right oil – remove tier 1 to get particle size – overall picture everyday
Oil is dispersible
Continuous monitoring of water column rather than discrete events
Surface vs subsurface dispersant – amount of weathering
Tier 2 – not specific data
GPS routes – see if boats are located where near planes are
Tier 1 = Eyeball aerial observation
Tier 2 = Fluorometry at 1 m below
Tier 3 = multiple depths
C3 = Fluorometer
Small aircraft, Big aircraft, sampling vessels
Better placement of tier 2 sampling vessels
Tier 1 and 3 are best – big boat tier 3
Property of oils on surface – weathering of source out to get properties and thickness of layer
Visual profile of oil
Treated and non-treated oil properties
Increasing amount of energy for dispersants – turbulence 1, 2 hrs after
Different levels of monitoring for different levels oil weathering
Fresh oil – tier 1
Tier 2 – proof of performance
Weathering profile – transitional phase - to see when dispersant is no longer needed
Emulsified oil as indicator of dispersant use
Deep water plume – know where is it
Amount of dispersant:flowrate of oil
Ratio of dispersant to oil – deep water
Droplet size – deep water
Temperature effect on dispersion
Amount of mixing energy and time – deep water
Emulsion may be dispersible with multiple applications of dispersant – needs to be researched
What is causing the small droplets at the surface?

2. What is the current state of knowledge regarding the DWH spill?

Location of plume: 1100 – 1300 ft moving SW direction
DWH oil high in alkanes, PAH similar to reference oil, up to C30
14-21% emulsified oil – may have come from skimmer
10-15% natural water and oil – surface oil (redish brown)
Less than C15 volatilizing
Max = 200,000 centistoke
Emulsified 5500-8500 centistoke
Need to know how oil is weathering on surface
Oil emulsion is non dispersible (15-20%) and when redish brown
Mousse is dispersing- not as good as before
Emulsion may be destabilizing (50-60%)
Take sample, add dispersant, shake, see if dispersed
Resurfacing – samples needed for what is resurfacing
C3 – calibration needed
C3 (fluorometer) gives relative trends – no level of total oil or degree of dispersion
(Need quick field tests)

3. What are the gaps in our knowledge or information?

   Similar to #1
   Can emulsions be dispersed with multiple applications?
   When is the endpoint of effective dispersance? Look at data
   Should other dispersant application methods be considered besides air (boat, subsurface)
   Oil flowrate – max, min
   Size of plume (volumetric)
   Leaching rate from small droplets
      Leaching rate - soluble components in oil
   Rate of dispersant in subsurface application (how well will it disperse)
   Is the plume of oil and dispersant rising together?

   a. Can these gaps be addressed using information from past experience and/or the literature?

      Lack of research on top surface

   Data to collect:
      Short Term – methane at surface, dispersant (if any), chemical dispersance vs. natural dispersance

   b. If not, what information should be collected in the short and long term?

Measure concentrations of oil and dispersants through water column

RECORDERS NOTES – GROUP A1 – MAY 27, 2010

Breakout Session II: Thursday morning

1. Develop input for the RRTs on subsurface dispersant use if the DWH release continues.
   MIXING -
   - -Dosage required – better understanding of required ratio (more systematic)
   - -Maximize contact time period between oil and dispersant from riser (shift wand position)
   - -Optimized mixing in riser – wand position (deeper is better – double or more), smaller nozzle on wand to increase fluid sheer (mixing on the small scale)
   - -Increase temperature of dispersant to lower viscosity – use oil to naturally heat dispersant? (collect data of droplet size as oil exits riser)
     - -oil is at 100 degrees C
     - -oil vs dispersant temperature experiments for best conditions?
   - -Short time of no dispersant (record data) followed by short time of dispersant usage (record data) and look for improvement to validate effectiveness

   DOSAGE –
   - -If mixing is optimal dispersant dose may be high
   - -Use minimum flowrate to derive DOR
     - Optimal in lab = 1:25
     - Measure oil flow (estimated 15,000 barrels/day ~450gpm)
     - Lower DOR is better (1:50 ~ 9gpm)
   - -If use the assumed 15,000 barrels/day AND 1:50 DOR, then actual dispersant flowrate stays roughly the same

   a. What are the tradeoffs (risks/benefits) associated with this input?

- Dosage
  - Risks

  If too low DOR, will not be getting maximized dispersion
  If high DOR, adding more dispersant to environment
  Are we doing enough dispersion?

  - Benefits

  Cut down need to add surface dispersants
  Protect shoreline
  Create smaller droplets that may degrade faster
  Avoid surfacing

- Mixing
    - Risks

    Lab results are based on STP and actual conditions differ (5,000ft and 100 C)
    Opportunity cost of having to make a new "nozzle" and deployment

    - Benefits

    More stable
    Kept below surface
    Lower droplet size
    More efficient delivery of dispersant

2. Identify possible monitoring protocols in the event of continuing dispersant use.

   Monitor for:
   Dispersant present on surface from subsurface injection
   Dispersant in water column
   Surface and depth for chemically dispersed vs. physically dispersed oil
      Potentially measured using GCMS/GCFID
      UVFS and LISST
   Tier 1 visual monitoring at surface with quantification of oil with aerial remote sensing
      Collect images

   Technique for surface and depth detection of dispersant
   No reference control monitoring of dispersion at depth
   Visual monitoring may demonstrate differences between dispersant application and no application – plume shape, color

RECORDER NOTES – GROUP A2 – MAY 27, 2010

Overall input:

1. **Surface application of dispersants has been demonstrated to be effective for the DWH incident and should continue to be used.**
2. **The use of chemical dispersants is needed to augment other response options because of a combination of factors for the DWH incident: 1) continuous, large volume release, 2) Relative proximity to sensitive wetlands, 3) winds and currents which may move the oil toward sensitive wetlands, and 4) Limitations of mechanical containment and recovery and in-situ burning.**
3. **Weathered DWH oil may be dispersible. Further lab and field studies are needed to assess the efficacy and effectiveness and optimal dispersant application (e.g., multiple dispersant applications).**
4. **Spotter airplanes are essential for good slick targeting for large scale aerial application (e.g., C130), so their use should be continued.**
5. **In order to most effectively use the assets available, the appropriate vessels or aircraft should be selected based on the size and location of the slick and condition of the oil. Vessels and smaller aircraft should be used to treat smaller slicks and the weathered DWH oil because they can target more accurately and repeatedly. Larger aircraft should be used for larger fresh oil slicks offshore except in the exclusion zone around the source. A matrix of oil location, oil patch slicks size and condition, dispersant technique/dosage, visual guidance, requirements for success/confirmation has been developed by the dispersant assessment group in Houma incident command. This matrix should be reviewed by the RRT.**

What are the tradeoffs (risks/benefits) associated with this input?

Risks: Dispersants will not be 100% effective. The matrix citied in #5 of overall input section above contains information to maximize the efficacy of dispersant

application on different states of the DWH oil. Dispersants redistribute the oil from the surface to the water column which is a tradeoff decision to be made by the RRT.

Benefits: Dispersing the oil reduces surface slicks and shoreline oiling. The use of chemical dispersants enhances the natural dispersion process (e.g., smaller droplet size enhances biodegradation). Dispersing the oil also reduces the amount of waste generated from mechanical containment and recovery and shoreline cleanup.

Relevant literature and field study information:

1. **Field data (tier 1 and tier 2) at the DWH site demonstrate that under calm seas aerial application of the dispersant is effective.**
2. **OHMSETT testing in calm seas and non-breaking waves on fresh oil demonstrated that dispersant will stay with oil and if energy subsequently increases, the oil will disperse. If it remains calm over a period of days, a fraction of the dispersant may leave the oil and dissolve in the water column (this is a function of underlying currents).**

Caveats:

1. **There are logistical difficulties in getting tier 2/3 (fluorometry) data for aerial application because of the 2 mile safety restriction on any vessel after the plane has sprayed. It may be 20-30 mins before the boat starts moving towards the perceived area of application. This may mean that the sampling vessels do not collect data where the dispersant was applied. This operational issue should be addressed.**
2. **The RRTs should develop criteria for discontinuing or altering dispersant operations.**

Question 2: Identify possible monitoring protocols in the event of continuing dispersant use.

Protocols:

1. **There is good correlation between tier 1 observations and tier 2 field fluorometry data. There has been sufficient tier 1 and 2 data collected for the DWH incident to indicate monitoring is not required for every sortie.**
2. **Going forward it is important to now focus on assessing the extent of the cumulative extent of the 3D area after multiple applications of dispersant on the surface. A sampling and monitoring plan to do this has been developed by the dispersant assessment group based in the Houma command center and initial implementation has begun. The RRT6 should review this plan.**

REPORT OUT – GROUP A1- MAY 26, 2010

Breakout Session I: Wednesday afternoon

1. What do we need to know in order to give input regarding dispersant operations and to identify possible monitoring protocols?

Where effectiveness is high and low or none
Continued use good for right oil – remove tier 1 to get particle size – overall picture everyday
Continuous monitoring of water column rather than discrete events
Surface vs subsurface dispersant – amount of weathering
GPS routes – see if boats are located where planes are near
Better placement of tier 2 sampling vessels
Property of oils on surface – weathering of source out to get properties and thickness of layer
Visual profile of oil
Treated and non-treated oil properties
Increasing amount of energy for dispersants – turbulence 1, 2 hrs after
Weathering profile – transitional phase - to see when dispersant is no longer needed
Deep water plume – know where is it
Amount of dispersant:flowrate of oil - DOR
Droplet size – deep water
Temperature effect on dispersion
Amount of mixing energy and time – deep water
Emulsion may be dispersible with multiple applications of dispersant – needs to be researched
What is causing the small droplets at the surface?
Oil emulsion is non dispersible (15-20%) and when reddish brown

Tier 1 = Eyeball aerial observation
Fluorometer confirms aerial observations
Tier 2 = Fluorometry at 1 m below
Tier 3 = multiple depths
C3 = Fluorometer
Fresh oil – tier 1
Tier 2 – proof of performance

2. What is the current state of knowledge regarding the DWH spill?

Location of plume: 1100 – 1300 m deep moving SW direction
DWH oil high in alkanes, PAH similar to reference oil, up to C30
14-21% emulsified oil – may have come from skimmer
10-15% natural water and oil – surface oil (redish brown)
Less than C15 volatilizing
Emulsified 5500-8500 centistoke
Mousse is dispersing- not as good as before
Emulsion may be destabilizing (50-60%)

C3 – calibration needed
C3 (fluorometer) gives relative trends – no level of total oil or degree of dispersion
(Need quick field tests)

3. What are the gaps in our knowledge or information?

   Similar to #1
   Can emulsions be dispersed with multiple applications?
   When is the endpoint of effective dispersance? Look at data
   Should other dispersant application methods be considered besides air (boat, subsurface)
   Oil flowrate – max, min
   Size of plume (volumetric)
   Leaching rate from small droplets
      Leaching rate - soluble components in oil
   Rate of dispersant in subsurface application (how well will it disperse)
   Is the plume of oil and dispersant rising together?
   Resurfacing – samples needed for what is resurfacing

   a. Can these gaps be addressed using information from past experience and/or the literature?

      Lack of research on top surface

   Data to collect:
      Short Term – methane at surface, dispersant (if any), chemical dispersance vs. natural dispersance

   b. If not, what information should be collected in the short and long term?

      Measure concentrations of oil and dispersants through water column

Deep Water Efficacy and Effectiveness

Group A

Day 2

Develop input for the RRTs on subsurface dispersant use if the DWH release continues

MIXING
- Dosage required better understanding of required ratio (more systematic)
- Maximize contact time period between oil and dispersant from riser (shift wand position)
- Optimized mixing in riser wand position (deeper is better double or more), smaller nozzle on wand to increase fluid sheer (mixing on the small scale)
- Increase temperature of dispersant to lower viscosity use oil to naturally heat dispersant? (collect data of droplet size as oil exits riser)
  - Oil is at 100 degrees C
  - Oil vs dispersant temperature experiments for best conditions?
- Short time of no dispersant (record data) followed by short time of dispersant usage (record data) and look for improvement to validate effectiveness

Question 1 (contd.)

DOSAGE –
- If mixing is optimal dispersant dose may be high
- Use minimum flowrate to derive DOR
  - Optimal in lab = 1:25
- Measure oil flow (estimated 15,000 barrels/day ~450gpm)
- Lower DOR is better (1:50 ~ 9gpm)
- If use the assumed 15,000 barrels/day AND 1:50 DOR, then actual dispersant flowrate stays roughly the same

What are the tradeoffs (risks/benefits) associated with this input?

Dosage Risks:
- If too low DOR, will not be getting maximized dispersion
- If high DOR, adding more dispersant to environment
- Are we optimizing dispersion?

Question 2 (contd.)

Dosage Benefits:
– Cut down need to add surface dispersants
– Create smaller droplets that may degrade faster
– Minimize surfacing

Mixing Risks:
– Lab results are based on STP and actual conditions differ
  - 5,000ft and 100 C (?)
– Opportunity cost of having to make a new "nozzle" and deployment

Mixing Benefits:
– More stable droplets
– Kept below surface
– Lower droplet size
– More efficient delivery of dispersant
– Potential for faster biodegradation (?)

Identify possible monitoring protocols in the event of continuing dispersant use

In the absence of reference control, monitor for:

Visual monitoring may demonstrate differences between dispersant application and no application
- Plume shape, color

Surface and depth for chemically dispersed vs. physically dispersed oil and dispersant itself
- Potentially measured using GCMS/GCFID
- UVFS and LISST

Tier 1 visual monitoring at surface with quantification of oil with aerial remote sensing
- Collect images

RECORDERS NOTES – GROUP B – MAY 26, 2010

Breakout Session I: Wednesday afternoon

1. What do we need to know in order to give input regarding dispersant operations and to identify possible monitoring protocols?

   Unknowns at depth
   - Contact efficiency between dispersant and oil
   - Release rate of oil and gas
   - Dispersion efficiency
   - Mixing energy at injection point
   - Dispersion at depth (pressure effects)
   - Temperature of released oil
   - Weathering of oil in rising plume (dissolution, vapor stripping)
   - Emulsion formation and dispersion under pressure
   - Destabilization of emulsions as pressure decreases
   - Emulsion formation in the rise zone before it hits the surface
   - Biodegradation rate on droplets at pressure and at bottom temperature
   - Movement at depth
   - Sedimentation of dispersed oil from depth
   - Biological uptake

   Unknowns at the surface
   - Langmuir circulation potential for mixing
   - Is advection fast enough to eliminate buildup

   Unknowns for airborne fate
   - BTEX levels above oil slick
   - Suppression of VOCs when using dispersants
   - Levels of 2-butoxy ethanol from spring
   - Atmospheric breakdown and toxicity of 2-butoxy ethanol and other products

2. What is the current state of knowledge regarding the DWH spill?
   - Surface models are effective and continuously improving
   - SMART protocols are improving
   - Increase of at depth sampling
   - Well researched region (oceanographic and ecological studies)
   - Well established baseline data
   - Airborne application protocols are established
   - Improved NEBA for dispersant use

3. What are the gaps in our knowledge or information?
    a. Can these gaps be addressed using information from past experience and/or the literature?
        - Norwegian experiment
        - Ixtoc 1

    b. If not, what information should be collected in the short and long term?

Short Term

- Remote sensing of the dispersed area
- Nested models
- Smaller grid sizes on models
- Further offshore surface sampling, either as increased SMART sampling or separate sampling regime
- Fixed stations or boat station monitoring sensing in the operational zone(continuous monitoring, water quality monitoring)
- Establishing criteria for cease of dispersant operations
- Guidelines for surface turbulence and dispersant effectiveness
- Contact efficiency between dispersant and oil
- Release rate of oil and gas
- Mixing energy at injection point
- Temperature of released oil

Long Term

- Better coupling between offshore and onshore hydrodynamic models (LaGrangian vs. Eulerian) L
- Dispersion efficiency
- Dispersion at depth (pressure effects)

RECORDERS NOTES – GROUP B – MAY 27, 2010

Breakout Session II: Thursday morning

1. Develop input for the RRTs on aerial and subsurface dispersant use if the DWH release continues.

    a. What are the tradeoffs (risks/benefits) associated with this input?

Benefits

Reduces threat distance and protects shorelines
Probable increase of biodegradation rate (result of smaller particles)
Inhibits emulsion formation=reduces bulk volume of pollutants
Reduces waste management
Potential reduction of VOC in air

Risks

Trades shoreline impact for water column impact
Increases uncertainty of fate
Increased sedimentation rate

2. Identify possible monitoring protocols in the event of continuing dispersant use.

- Measure Size and shape of plume
    - With and without subsurface injection of dispersant
    - Sonar monitoring of plume size and morphology (tilt)
        - Plume size increasing= greater dispersion=better effectiveness
    - More plume monitoring in the rising plume at a variety of depths
    - Important for transport modeling
        - Development of boundaries and constraints on estimates
    - Measures needed
        - Water Temperature
        - Particle size distribution
        - Fluorescence monitoring of dispersant
        - TPH

- Define geographic area/water volume of concern
    - Estimates for scale of impact (first order approximation)
        - Based on current application rates
        - Based on maximum concentration in that volume (worst case scenarios)
        - Scenarios for surface water, onshore, deepwater plumes
    - Important for NEBA analysis

- Create an environmental review committee to advise SSCs
    - Clearinghouse for environmental data
    - Multi-agency and academia
    - Meeting regularly
    - Focused on immediate operational and scientific advice
    - eg. Rapid evaluation of dispersant options
        - Product selection based on:
            - Effectivenesss
            - Toxicity
            - Modeling
            - NEBA
            - Environmental conditions

- Surface layer water quality monitoring (profile of upper 10 m)
    - Concerns of cumulative loading of water (oil, dispersant)
    - Size of monitoring zone
        - Based on anticipated advection and dispersant application
    - Tests of concern
        - TPH
        - TPAH
        - DO
        - Salinity/ Temperature
        - VOA
        - BOD
        - Surfactant monitoring (possible?)
        - Tox testing (?)

- Air monitoring of same surface water quality zone
        - BTEX/VOC levels
        - 2-butoxy ethanol (in case of corexit 9527)
    - Aerial spectral monitoring

REPORT OUT – GROUP B – MAY 26, 2010 (USED RECORDERS NOTES)

Breakout Session I: Wednesday afternoon

1. What do we need to know in order to give input regarding dispersant operations and to identify possible monitoring protocols?

   Unknowns at depth
   - Contact efficiency between dispersant and oil
   - Release rate of oil and gas
   - Dispersion efficiency
   - Mixing energy at injection point
   - Dispersion at depth (pressure effects)
   - Temperature of released oil
   - Weathering of oil in rising plume (dissolution, vapor stripping)
   - Emulsion formation and dispersion under pressure
   - Destabilization of emulsions as pressure decreases
   - Emulsion formation in the rise zone before it hits the surface
   - Biodegradation rate on droplets at pressure and at bottom temperature
   - Movement at depth
   - Sedimentation of dispersed oil from depth
   - Biological uptake

   Unknowns at the surface
   - Langmuir circulation potential for mixing
   - Is advection fast enough to eliminate buildup

   Unknowns for airborne fate
   - BTEX levels above oil slick
   - Suppression of VOCs when using dispersants
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    b. If not, what information should be collected in the short and long term?

    Short Term
        - Remote sensing of the dispersed area
        - Nested models
        - Smaller grid sizes on models
        - Further offshore surface sampling, either as increased SMART sampling or separate sampling regime
        - Fixed stations or boat station monitoring sensing in the operational zone(continuous monitoring, water quality monitoring)
        - Establishing criteria for cease of dispersant operations
        - Guidelines for surface turbulence and dispersant effectiveness
        - Contact efficiency between dispersant and oil
        - Release rate of oil and gas
        - Mixing energy at injection point
        - Temperature of released oil

Long Term
        - Better coupling between offshore and onshore hydrodynamic models (LaGrangian vs. Eulerian) L
        - Dispersion efficiency
        - Dispersion at depth (pressure effects)

Group B: Fate and Behavior

Fate And Transport: Benefits

- Reduces threat distance and protects shorelines
- Probable increase of biodegradation rate
- Inhibits emulsion formation
- Reduces pollutant bulk and waste management
- Potential reduction of VOC in air

Fate and Transport: Risks

- Trades shoreline impact for water column impact
- Increases uncertainty of fate
- Increased sedimentation rate

1. Create an environmental review committee to advise SSCs

Clearinghouse for environmental data
Multi agency and academia
Meeting regularly for entire course of spill
Focused on immediate operational and scientific advice
eg. Rapid evaluation of dispersant options

- Product selection based on:
  - Effectivenesss
  - Toxicity
  - Modeling
  - NEBA
  - Environmental conditions

2. Measure Size and shape of Rising Plume

- With and without subsurface injection of dispersant
- Sonar monitoring of plume size and morphology (tilt)
  - Plume size increasing---greater dispersion---better effectiveness
- More plume monitoring in the rising plume at a variety of depths
- Important for transport modeling
  - Development of boundaries and constraints on estimates
- Measures needed
  - Water Temperature
  - Particle size distribution
  - Fluorescence monitoring of dispersant
  - TPH

3. Define geographic area/water volume of concern

- Estimates for scale of impact
- first order approximation
  - Based on current application rates
  - Based on maximum concentration in that volume (worst case scenarios)
  - Scenarios for surface water, onshore, deepwater plumes
- Important for NEBA analysis
- NOAA/EPA deep water sub surface dispersed plume monitoring

4. Surface layer water quality monitoring

- Profile of upper 10 m
  - Concerns of cumulative loading of water (oil, dispersant)
  - Size of monitoring zone
    - Based on anticipated advection and dispersant application
  - Tests of concern
    - TPH
    - TPAH
    - DO
    - Salinity/ Temperature
    - VOA
    - BOD
    - Surfactant monitoring (possible?)
    - Tox testing (?)

5. Air monitoring of same surface water quality zone

- BTEX/VOC levels
- 2-butoxy ethanol (in case of corexit 9527)
- Aerial spectral monitoring

RECORDERS NOTES – GROUP C – MAY 26 2010

Breakout Session I: Wednesday afternoon

1. What do we need to know in order to give input regarding dispersant operations and to identify possible monitoring protocols?
   - **Much less known about deep ocean systems compared to surface water**
   - **Biochemical, trophicdynamics effects of the dispersant rate**
   - What specifically is at risk?
   - What are the receptor species?
   - Life histories of local species, migration, feeding habits
   - **Identify species at risk (migration, feeding habits, life histories, reproductive/ recruitment strategies)**
   - What are the reproductive strategies/recruitment of the species affected?
   - What parts of the ecosystem are affected?
   -
   - **Dispersant effect of oxygen levels and cycling, modeling, maximum rates of application**
   - How much will it affect the nutrient recycling, general efficiency of food chain
   - **What is the particle size distribution as a function of depth, dispersant application rate**
   - Emphasis needs to be put on water scale when considering effects
   - **Understand the biodegradation rates, microbial structure and function**
   - Evaluate the need for another team for data analysis
   - Look at seasonal dynamics etc of oxygen demand
   - Naval research lab organics, hydrocarbons
   - Microbial structure and function
   - **Scavenging particle interactions, oil-mineral aggregate formation at source and throughout water column**
   - **Transport dynamics of deep water ocean currents**
   - Rate of water absorption
   - Unknown latent effects, persistence?
   - How much is the dispersant/spill affecting the oxygen demand compared to other natural seeps and sources?
   - Follow the fate
   - **Evaluate the tradeoffs between dispersant application costs vs surface reduction in oil**
   - Percent effectiveness of the seafloor dispersant application
   - **Further research on where dispersion occurs in the water column**
   - Transport to surface?
   - Does the addition of dispersant change the microbial degradation due to selective metabolism
   - Effectiveness of natural dispersion

- Knowing the downstream flux of oil residue from the spill to the seafloor

2. What is the current state of knowledge regarding the DWH spill?

- MMS report on gulf of mexico deep water resources (2000-049 Review of list for GOM including area, deep water fish, fauna and seepage)
- MMS – vulnerability of DW species to oil spills
- Natural hydrocarbon seepage in the GOM, 40 MG/year
- Receptor paper by Alan Mearns
- Existing reports e.g. MMS, NOAA
- Deep water species in the GOM, Kathys reference
- Preliminary modeling
- Preliminary monitoring data (Fluorometry data, Particle size analysis, Temperature, Salinity, D.O., Hydrocarbon, Acute toxicity , Acoustic data, sonar, Genomics)

- Looking at microbial structure, Berkley
- *None of the info listed above is considered "complete"

3. What are the gaps in our knowledge or information?
    i. Models not validated from #2
    ii. Life history of benthic biota
    iii. Migratory patterns, residence time
    iv. Incomplete data
    v. Microbial degradation rates in deep ocean on hydrocarbon seeps
    vi. Byproducts
    vii. Chronic toxicity of benthic biota
        1. Leads to community and ecosystem effects
        2. Comparison of bioaccumulation/bioavailability between different droplet sizes
        3. Comparison of toxicity and environmental impact of natural vs chemically enhanced dispersed oil
    viii. Weighing the costs/benefits, and tradeoffs
    ix. Species avoidance of oil?
    x. Evaluate the tradeoffs between dispersant application costs vs quantitative surface expression in oil
    xi.

    b. Can these gaps be addressed using information from past experience and/or the literature?

- Chronic and acute toxicology cannot apply to these deep water settings, some data but we have large gaps
- In many cases we can't trust previous techniques
    - Advances in microbiology technology
- Existing studies concerning deep water toxicity of pesticides on forams

c. If not, what information should be collected in the short and long term?

- Formulation of biogeochemical rates wrt fuel transport and sedimentation
- Early life stage studies, laboratory or caging

RECORDERS NOTES – GROUP C – MAY 27 2010

Breakout Session II: Thursday morning

1. Develop input for the RRTs on subsurface dispersant use if the DWH release continues.
    a. What are the tradeoffs (risks/benefits) associated with this input?

    BENEFITS

    - Offshore/nearshore biological tradeoffs
    - Surface impacts vs. water column impacts
    - Initial evidence of greater efficiency with subsurface/point source application vs. aerial application
    - Observed reduction in volatile organics at surface w.r.t. personnel safety
    - Enhances the interaction between oil and suspended particulate material
    - accelerated microbial degradation through increased bioavailability
    - more rapid recovery of downward sulfate diffusion and upward methane diffusion related to shallow sediment geochemistry
    - Based on current knowledge confines the aerial extent of impact
        - Current impact zone is far less than 50 km
    - Reduction emulsified oil at the surface
    - Reduction of phototoxic impacts

    RISKS

    - Increases the extent of impact at depth
        - Biological impacts to deep water pelagic/benthic organisms
        - Concern with oxygen depletion (Note: 0.7 µg C/L/day tPAH *Coffin)
        - Release of VOCs in the water column
    - Change in microbial community diversity, structure, and function
        - Change in trophic level dynamics
        - Leading to changes in key biogeochemical cycles
    - Risk assessment should consider volume of Horizon spill relative to natural seepage
    - Future application rates unknown with future operations (small contained high concentration zone compared to larger lower concentration zone with the possibility of future growth)
    - Re-coalescing and movement to surface remotely – surface slick
    - Exhaust dispersant supply

    Based on the net benefit, but recognizing incomplete information, the group agrees with subsurface dispersant injection as an immediate option.

2. Identify possible monitoring protocols in the event of continuing dispersant use.
    - Robust deep ocean toxicity studies

- Application of research done with acute toxicity on forams, possibility of chronic studies (LC50, EC50)
- Identify control areas
- Caged studies in the plume
- Identify surrogate/indicator species for impacts over a range of trophic levels
- Identify key species of concern (migrating fauna?)
- Microbial genomics
- Long term biological effects for resident species with baseline information

- Biogeochemical monitoring
  - Petroleum degradation rates (C14 labels)
  - Microbial production and function (3H thymodine/Genomics)
  - Community diversity (16S RNA)
  - Background parameters (DOC, POC, DIC, concentration and dC13)
  - Bioavailability of the oil as a function of particle size

- Physical/chemical parameters
  - UV Fluorometry (Including FIR)
  - Monitor the particle size distribution of the oil as function of space and time (LISST particle counters)
  - Current velocity (ADCP)
  - Chemical properties CTD (oxygen, salinity, pH, SPM)
  - Chemical properties of the oil as a function of space and time (GC-MS)
  - Potential of acoustic monitoring (3.5 and 12 khz)

Use of data from all of the above for the development of predictive models.

- **Validation!**

Group C: Biological Effects on Deep Water Ecosystem; Subsurface Application

Report Out I: Wednesday, May 26, 2010

Deep Ocean: Needed Knowledge to Give Input to RRTs

- **Much less known about deep ocean systems compared to surface water**
- **Biochemical, trophic dynamics effects of the dispersant rate**
- **Identify species at risk (migration, feeding habits, life histories, reproductive/ recruitment strategies)**
- **Dispersant effect of oxygen levels and cycling, modeling, maximum rates of application**
- **What is the particle size distribution as a function of depth, dispersant application rate**
- **Understand the biodegradation rates, microbial structure and function**
- **Scavenging particle interactions, oil-mineral aggregate formation at source and throughout water column**
- **Transport dynamics of deep water ocean currents**
- **Evaluate the tradeoffs between dispersant application costs vs surface reduction in oil**
- **Further research on where dispersion occurs in the water column**

Deep Ocean: Current Knowledge

- Natural hydrocarbon seepage in the GOM, 40 MG/year
- Existing reports e.g. MMS, NOAA
- Preliminary modeling
- Preliminary monitoring data (Fluorometry data, Particle size analysis, Temperature, Salinity, D.O., Hydrocarbon, Acute toxicity , Acoustic data, sonar, Genomics)

Deep Ocean: Gaps In Knowledge

- Model validation of subsurface dispersion and biogeochemical cycles
- Byproducts
- Migratory patterns, residence time
- Comparison of toxicity and environmental impact of natural vs chemically enhanced dispersed oil
- Evaluate the tradeoffs between dispersant application costs vs quantitative surface expression in oil

Deep Ocean: Can These Gaps be Addressed?

- Chronic and acute toxicology cannot apply to these deep water settings, some data but we have large gaps
- In many cases we can't trust previous techniques
  - Advances in microbiology technology
- Existing studies concerning deep water toxicity of pesticides on forams

Group C: Biological Effects on Deep Water Ecosystem; Subsurface Application

Report Out II: Thursday, May 27, 2010

Tradeoffs of Subsurface Dispersant Application

RISKS

- **Increases the extent of impact at depth**
  - **Biological impacts to deep water pelagic/benthic organisms**
  - **Concern with oxygen depletion (Note: 0.7 µg C/L/day tPAH)**
  - **Release of VOCs in the water column**
- **Change in microbial community diversity, structure, and function**
  - **Change in trophic level dynamics**
  - **Leading to changes in key biogeochemical cycles**
- **Risk assessment should consider volume of Horizon spill relative to natural seepage**
- **Future application rates unknown with future operations (small contained high concentration zone compared to larger lower concentration zone with the possibility of future growth)**
- **Re-coalescing and movement to surface remotely surface slick**
- **Exhaust dispersant supply**

Tradeoffs of Subsurface Dispersant Application

BENEFITS

- **Offshore/near shore biological tradeoffs**
- **Surface impacts vs. water column impacts**
- **Initial evidence of greater efficiency with subsurface/point source application vs. aerial application**
- **Observed reduction in volatile organics at surface w.r.t. personnel safety**
- **Enhances the interaction between oil and suspended particulate material**
- **Accelerated microbial degradation through increased bioavailability**
- **More rapid recovery of downward sulfate diffusion and upward methane diffusion related to shallow sediment geochemistry**
- **Based on current knowledge confines the aerial extent of impact**
  - **Current impact zone is far less than 50 km**
- **Reduction emulsified oil at the surface**
- **Reduction of phototoxic impacts**

Input!

- Based on the net benefit, but recognizing incomplete information, the group agrees with subsurface dispersant injection as an immediate option

Deep Ocean Monitoring Protocols

- Robust deep ocean toxicity studies
  - Application of research done with acute toxicity on forams, possibility of chronic studies (LC50, EC50)
  - Identify control areas
  - Caged studies in the plume
  - Identify surrogate/indicator species for impacts over a range of trophic levels
  - Identify key species of concern (migrating fauna?)
  - Microbial genomics
  - Long term biological effects for resident species with baseline information

Deep Ocean Monitoring Protocols

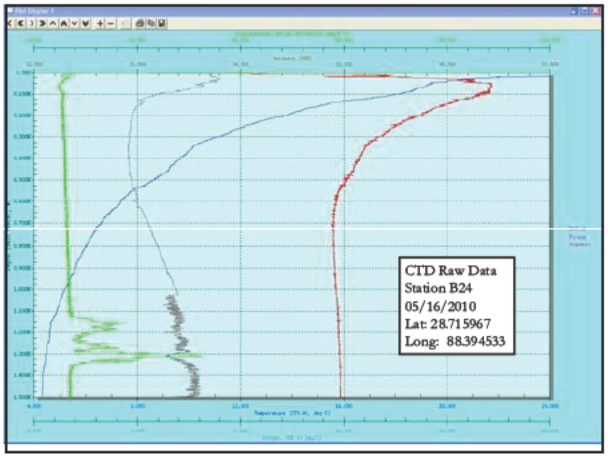
- Biogeochemical monitoring
  - Petroleum degradation rates (C14 labels)
  - Microbial production and function (3H thymodine/Genomics)
  - Community diversity (16S RNA)
  - Background parameters (DOC, POC, DIC, concentration and dC13)
  - Bioavailability of the oil as a function of particle size

Deep Ocean Monitoring Protocols

- Physical/chemical parameters
  - UV Fluorometry (Including FIR)
  - Monitor the particle size distribution of the oil as function of space and time (LISST particle counters)
  - Current velocity (ADCP)
  - Chemical properties CTD (oxygen, salinity, pH, SPM)
  - Chemical properties of the oil as a function of space and time (GC MS)
  - Potential of acoustic monitoring (3.5 and 12 khz)

Modeling

- Use of monitoring data for the development and validation of predictive models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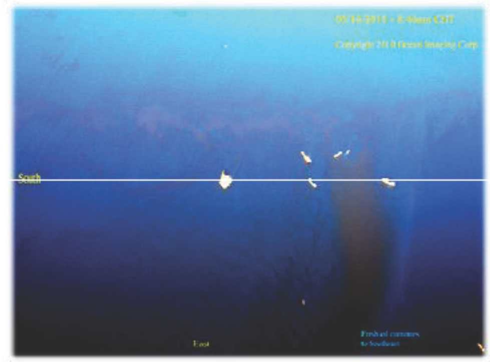
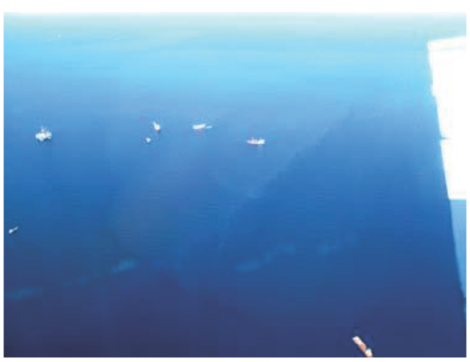




RECORDERS NOTES – GROUP D - MAY 26 2010

Breakout Session I: Wednesday afternoon
Shallow water

1. What do we need to know in order to give input regarding dispersant operations and to identify possible monitoring protocols?
   - Chemical composition of oil and dispersants
     - Real toxicity is from oil not corexit
     - Test corexit toxicity-short term
   - Impact to health of fisheries resources
   - Potential impact to human health from consumption of seafood
     - Assessment tool for critical habitats
   - Spatial and temporal distribution of concentrations of oil constituents
     - Knowing dissolved phase and particulate hydrocarbon
     - Toxicity on species-bioassays
     - Comparing water composition of mixtures (oil:water)
     - 3D exposure environment (depth and from shore then moving towards spill)
   - Criteria tool for long term habitat monitoring
   - Submerged aquatic vegetation
   - Physical and chemical, exposure pathways, what is being exposed (surface vs depth;LC50, LD50)
   - Federal tests for platforms also apply to products used
   - Some constituents disperse naturally
   - Surface oil moves with wind, dispersed oil in water column moves with currents
   - Effects of riverine system on how dispersants work (salinity concentrations)
   - Toxicity in water column and where is it
     - Physical and chemical dispersion, proximity to dispersant application location
   - Acute vs chronic toxicity-what information is needed to decide whether dispersant use is or is not needed
   - Define benchmarks
   - Many exposure pathways, bioassays could benefit
   - Limit on concentrations and exposure/effects. Chemistry threshold
   - Toxicity – equilibrium partitioning, chronic effects concerns, safety factor of 10 to apply to standard benchmarks
   - *Toxicity tests using rototox (?), but only at deepwater dispersion*
     - *What is known and how a rototox test works*
   - *Federally mandated bioassays in Gulf of Mexico*
   - Effects to biological components- PAH residuals as benchmarks
     - New monitoring device aside from what is used
   - DO level
   - Photo-enhanced toxicity
     - Normal lab studies do not capture this

- What larvae are out there that will absorb oil and be subjected to those phototoxicity effects.
    - What depth are these species at
- What is the exact depth of surface dispersed oil plume
- Deeper than ten meters, physical and chemical aspect of oil droplets unknown
- Monitoring at 5,000ft depth, is there a plume?
    - –using fluorescence for subsurface dispersed patterns
    - Fluorescent transects will document what happened to decision that's been made
- Baseline data prior to the oil reaching that area
    - Trace PAHs in water column
    - Gaps- having enough transect profile data moving away from shoreline (baselines)
    - Some data has been collected
- Agreement among involved parties on toxicity benchmarks
- NOAA fisheries proposed studies and monitoring for seafood safety and levels of concern (conservative levels)
- Rate of degradation of oil vs. dispersed oil
    - Biproducts of degradation, and relative toxicity
    - True residence time of volatile fractions (dispersed vs. non)-present LSU studies
    - Seasonal factors
    - Other degradation factors (e.g., dead zone)
        - Will this in turn influence dead zone, DO, etc
- Species type- exposure duration, pathways, variations amongst species; if there are numbers, what are they based on (which tox tests)?
- Rototox assay is very general thing
- Dose- disperse compounds, how long do plumes persist, are they mixed in the water column. What level is negligible?
    - Undetectable limits but still have effects on species
- Spatial and temporal fluorescence for basic infrastructure. Assist in evaluating use of dispersants.
    - Is it toxic, what are the adverse effects
- Species out there, area, concentration, threshold levels, protecting which species
    - Area, number of species and concentrations in regions
- Continual spill, risks may equal out of effected species in water column to shoreline
- Seasonality distribution of species, larvae
- Influence top of water column that feed rest of food chain will eventually affect shoreline species anyway. Tradeoffs
- How long does it last, where does it go?
- Life periods of species and how they will be effected (e.g., killifish vs. blue fin tuna)
- What biota is in the vicinity of the dispersants
- Degradation components of dispersants not well known in terms of accumulation
- Persistent components of dispersants
- Are dispersants bioaccumulated

- Information be made available for decision makers
- How toxic is dispersant, how much in relation to oil, is oil more toxic when dispersed. Is this loss acceptable knowing that it may save the shoreline….tradeoffs
- Are dispersants giving us enough relief (looking at ERMA map)? How much of a reduction will we get in oil hitting the shoreline. Relative to total volume
- Does it make a difference in the end with total amounts of oil that will and would have reached the shore had it not have been dispersed.
- What is the oil that is coming ashore now? Not sure if oil moving on shore is exactly dispersed oil or non.

2. What is the current state of knowledge regarding the DWH spill?
    - Water samples with no oil concentrations came from inshore samples prior to oil making landfall
    - Fluorescence methods to monitor subsurface dispersed oil
    - Hypoxia-EPA-mapping hypoxic zone, just mapping it, not looking at influence on biodegradation potential
    - Good to disperse if it doesn't get into coastal zone
    - Persistence of dispersant is around 7days
    - Potential bioaccumulation on some aspects of dispersants (MSDS)
    - EPA PAH datas. Priority pollutants (not full range). Push for GCMS
    - Petroleum distillates in corexit: known animal carcinogen in the MSDS for petroleum distillates
    - If use dispersants, oil in top 10m of water column will cause injury to species in that area.
    - More oil is dispersed when using dispersants at wellhead.
    - Aerial application- effectiveness drops off
    - Oil that comes ashore hasn't been dispersed. Not likely to have recoalesced
    - RRT discussion on lifting restrictions on dispersant application areas

3. What are the gaps in our knowledge or information?
    1. Can these gaps be addressed using information from past experience and/or the literature?
        - Pulling data together and synthesizing
        - Water samples throughout depth up to 5,000ft (LSU)
        - Pharmaceutical products-endocrine disrupting properties
        - IXTOC -140M barrels of oil, 2M gallons of oil applied.
        - Exxon Valdez, oil that came ashore, still have a fraction of it after 20 years
        - Leave marsh alone, it cleans itself, what are the orders of magnitude

- How much oil gets onto marsh plants dictates lethality
- Want to keep it off the nursery ground
- State dependent upon species from these habitat areas
- Pelagic fish and organisms. Bluefin tuna exp. Will we lose that species (deep water species)

2. If not, what information should be collected in the short and long term?
    - EPA, BP data compilation
    - What is the distribution of sensitive species offshore
    - Distribution of dispersed oil
        1. larva data and commercial species
- oyster and mussel examples for monitoring
- SPMD monitoring (30days-has some biofouling)
    - Benefit future dispersant decisions
-

Breakout Session II: Thursday morning

1. **Develop input for the RRTs on aerial and subsurface dispersant use if the DWH release continues.**
    a. **What are the tradeoffs (risks/benefits) associated with this input?**

- Report 50% loss of fisheries (menhaden-spawn in marshes, life in open ocean)
- Commercially important species –top ten meters (location marshes to open ocean)
- San Bernard shoals type of oil (dispersed or non) doesn't matter, area is already compromised
- Major fisheries in open oceans
- MSDS states no toxicity tests required
- **Consider offshore fisheries (one species against the other-inshore fisheries and shrimping grounds vs. offshore)**
- First hit for summer fishing season will be menhaden
- Southeast fisheries science center has information on species location
- No environmental impact statement required for this location
- **Scrutinize MMS document (bluefin tuna and menhaden)**
- MSDS for corexit has LC50 (consider dose)
- Does the dispersant make oil more toxic because it's more available? More animals see more of the oil. If dilution is fast enough, the species will see less of it (dose)
- Theory: increase oil in water column then "go away"
- Oil slick-worry about birds, etc, if you disperse it goes to top ten meters of water column and threatens those species. Then habitat concerns
- **Transfer risk from surface to subsurface, then worry about habitat contamination if it comes ashore**

- Lessons from Persian gulf, no concentrations in water, but dig into sediments to find oil there
- **Long term effects as opposed to short term acute effects.**
- Half life and concentration. Creating a different effect than the MSDS sheet has information for
- Subsurface water and surface water move in different directions which lowers the dose (of oil?)
- Dispersants speed up natural process which lowers the dose. Could wipe out phyto and zooplankton in dispersant areas. Fluorescence shows oil location and how effective oil dispersion is.
- Corexit breaks down relatively quickly (in a lab)
- Propylene glycol dissolves in water, dilutes rapidly, can adhere to particulates (?), its solubility is affected by propylene distillates.
- Microbes degrade soluble and non-soluble components
- **Toxicity as lethality and not so much long term chronic effects. Risk and uncertainty in terms of how much over what area, what species are there.**
- Sub lethal effects with long ranging impacts. If you contaminate habitat you extend the range of those impacts
- How much of a difference are we really making by using dispersants (looking at ERMA map)-small area of application
- What is the effectiveness of the dispersed treatment?
- Is it worth it if we're still going to have impacts to the exact habitat we're trying to protect?
    - Once you've added a volume it takes a certain time for the marsh to clear it, so the more oil there the more time.
    - 430,000gallon application with 10:1 ratio. You save approximately 1-10M gal of oil off the shore
    - Application may not be as efficacious as expected; dispersants may be over applied
    - 2 weeks ago, reevaluated dispersant application
    - EPA is pro deep dispersant application
    - Smart data shows that there is dispersion into the water column-only monitors down to 10m

    - Public perception is that the oil slick is dropped slightly into the water column, below surface, not that it is broken into small droplets.
- What is the application rate? Then you can calculate dilution rate
- Dispersant is less toxic than oil and applied in smaller concentration than oil. Thus, more worried about oil toxicity
- Dispersant may facilitate PAH uptake in organisms and increase dissolved phase of PAHs enhancing bioavailability
- Mechanisms of uptake and physical characteristics of dispersed oil (sticking to species). Bacterial degradation (much conflicting data on uptake and exposure routes)
- **Mechanisms of PAH availability and toxicity resulting from dispersant use and making PAHs more bioavailable**
- More dispersant-increase toxicity, not the dispersant itself, just what it does. Endocrine disruption, carcinogenicity
- Solely disperse deep water, need to fully know the efficacy and effects. Think they can get same dispersion with deep water injection. Believe dispersed oil will remain below pycnocline
- Halted surface water dispersion
- **Use of dispersants should continue to lessen extent of shoreline oiling. Tradeoffs with species in open ocean water column**
- Small reduction in oil (even 1%) is it beneficial? What is the objective of dispersant application
- How much of the slick are you actually getting to (about 1M gallon?)
- **Dose, duration, and spatial context**
- All an experiment, controlled or not
- A lot of marsh that hasn't been hit yet, small fraction of LA marshes have been oiled
- If you apply dispersants and it's just washing around, if it's effects are less than the oil, then what's the risk?
- If we spray it on open water, or it isn't effective, then what's downside to applying it? There is no real downside (aside from

potential unknowns of dispersants, their residence time, and toxicity)

- Can only apply dispersant when conditions are adequate (to create mixing)
- Currents, where things are going, where's the plume? Consistent plume? Kill the tight plume and not worry about everything else?
- Species sensitivity (e.g., corals would be killed by dispersed oil)
- What is your footprint damage
- More data on open oceans, how much harm is being done?
- Big uncertainty
- **Data gaps: what is being exposed, exposure time.**
- **If dispersant application mitigates a small percentage of oil in marshes, it may have a beneficial tradeoff. Are the beneficial tradeoffs acceptable?**
- Spatial mapping –not adequate density
- Too many unknowns-never going to get to a comfortable stage, even with a five year plan

2. Identify possible monitoring protocols in the event of continuing dispersant use.

- **Monitor deeper than 10meters (below 20meters or until no fluorescence doesn't work)**
- **Monitor surface to bottom across a transect from the shore to source**
  - **Gradation out from shore**
  - **If not in this spill, beneficial to future spills**
- Need grid
- **Deploy semi permeable membrane device (SPMD), passive sampling, or oysters**

- Oysters take about 30 days to reach equilibrium
- Objectives? Detailed species questions
- Damage assessment, tracking and exposure
- What limits microbes
- **Bioaccumulation monitors at selective points along transect**
- **Concentration monitoring (dose) and exposure time**
- **How big is the footprint of dispersed oil**? Is there naturally dispersed oil in other areas; compare and measure how much dispersant is in water.
- **Measure current (subsurface) prior to application**
- **Measure DO**
    - **pH, temp, pressure, salinity, particle size, fluorometry, turbidity**
- **Monitor/measure physical parameters, put into model to figure concentration to measure toxicity**
- **Biological species indicators (indicator species, chlorophyll,)**
    - eggs or larval abnormalities-long term monitoring
- coordination with NRDA
- oil vs dispersant effects
- shrimp moving out of marshes and into ocean now
- Baseline species and behavior verse effects from oil and dispersed oil
- **Hypoxic zone**
    - **M**atch up where chemical vs DO signal are
    - Correlation between river volume (flood) and hypoxic zone
    - Baseline data
- Need to prove where the oil and dispersed oil is
- **Track oil!**
    - **Where chemicals are going, exposure regimes**
    - **Dealing with uncertainty**
- Would this data help managers?

- What is the effect of the dispersant; is it an adverse effect? If so, how much?
    - Small and localized
    - Tradeoff for keeping oil out of the marsh
- **Ecosystems will recover after oil shock to system, open ocean ecosystems may rebound faster than marsh areas; worthwhile to apply dispersants**
- **Opportunity to learn**
- Tracking unknown oil in deep sea-
- **surface, start monitoring plan NOW. Start prior to potential future surface dispersant application**
    - Data set will be beneficial in damage assessment as well
    - Beneficial for dispersant or not
- **Toxicity tests-state of the art (standard 48hour tests)**
    - Bioassays; bioassay based decision tree
        - Important for public perception
    - 24 hour acute tox screen
    - Show public toxicity levels, ease concern
- Tox tests on underwater dispersion (rototox indicates not much toxicity)
- Don't know what tests to suggest (microtox)
- Manidya, mica, alga
- Public does care –sublethal effects, chronic effects
- **Selected bioassays at selected sampling points**
    - **Water**
    - **Sediment? If it comes ashore, definitely**
- Seafood safety-marketing
- Transfer risk to 10m is lesser of evils. Dispersant use on surface okay
- Water measurements dispersants and oil
- DO measurements
- Toxicity tests: selected bioassays
- **More confidence in where oil is going**

- **Mussel watch –time aspect, before and after oil spill**
    - Long term monitoring (monthly)

Sediment doesn't necessarily reflect dispersant use…need baseline and background for oil in sediment
Sediment baselines for future

Powerpoint presentation recommendations:

- Surface application of dispersants is ok
    - Transfer risk to 10m is lesser of evils
- Monitoring to provide more confidence in where oil is going
    - Long term monitoring (monthly); grid from inshore to open ocean (past oil slick edge)
    - Passive samplers in selected areas
    - Water measurements dispersants and oil
    - DO measurements
    - Toxicity tests: selected bioassays
    - Standard CTD tests plus chlorophyll measurements

Q1: What do we need to know in order to give input regarding dispersant operations and to identify possible monitoring protocols?

- Location, location, location
  - Oil, dispersants, critters
- Levels of concern?
  - E.g., sensitive life stages
  - Oil and dispersant constituents

Q2: What is the current state of knowledge regarding the DWH spill?

- Dispersed oil in shallow water (10m)

What are the gaps in our knowledge or information?

- Effectiveness of dispersant
- Long term effects of dispersant exposure (carcinogenicity)
- Dispersed oil effects in an estuarine/riverine/pelagic environment
- Bioavailability, bioaccumulation (SPMD)

Recommendations

- Clearinghouse for baseline data being collected
- Know dose of exposure, effects, species present and tradeoffs with habitat protection
  - Dispersed verse non dispersed oil

Recommendations

- Surface application of dispersants is ok
  - Transfer risk to 10m is lesser of evils
- Monitoring to provide more confidence in where oil is going
  - Long term monitoring (monthly); grid from inshore to open ocean (past oil slick edge)
  - Passive samplers in selected areas
  - Water measurements dispersants and oil
  - DO measurements
  - Toxicity tests: selected bioassays
  - Standard CTD tests plus chlorophyll measurements

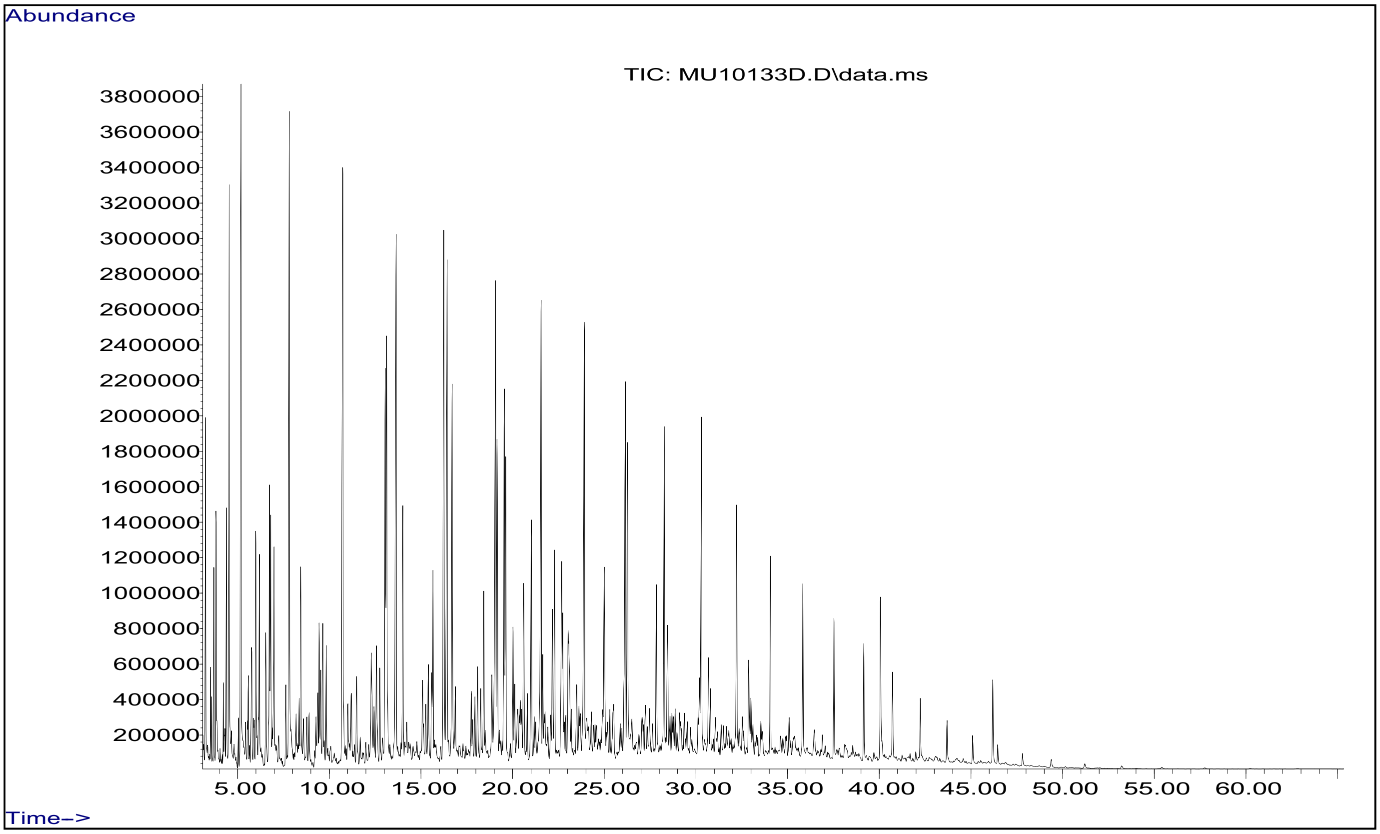
APPENDIX F

Courtesy Bruce Hollebone, Environment Canada

LSU ID#: 2010133-02 **Source Oil, Pre-spill** **Sample Weight:** 310 mg **Final Extracted Volume:** 30 mL		**LSU ID#: Lab Ref Oil** **South Louisiana Crude** **Sample Weight:** 500 mg **Final Extracted Volume:** 20 mL	
Alkane Analyte:	Concentration (ng/mg)	Alkane Analyte:	Concentration (ng/mg)
nC-10 Decane	2600	nC-10 Decane	2600
nC-11 Undecane	2600	nC-11 Undecane	2700
nC-12 Dodecane	2600	nC-12 Dodecane	2600
nC-13 Tridecane	2500	nC-13 Tridecane	2600
nC-14 Tetradecane	2400	nC-14 Tetradecane	2300
nC-15 Pentadecane	2000	nC-15 Pentadecane	2200
nC-16 Hexadecane	1800	nC-16 Hexadecane	2000
nC-17 Heptadecane	1700	nC-17 Heptadecane	1900
Pristane	960	Pristane	970
nC-18 Octadecane	1500	nC-18 Octadecane	1700
Phytane	770	Phytane	910
nC-19 Nonadecane	1300	nC-19 Nonadecane	1500
nC-20 Eicosane	1300	nC-20 Eicosane	1400
nC-21 Heneicosane	1100	nC-21 Heneicosane	1300
nC-22 Docosane	1000	nC-22 Docosane	1200
nC-23 Tricosane	940	nC-23 Tricosane	1100
nC-24 Tetracosane	890	nC-24 Tetracosane	1000
nC-25 Pentacosane	600	nC-25 Pentacosane	620
nC-26 Hexacosane	510	nC-26 Hexacosane	510
nC-27 Heptacosane	350	nC-27 Heptacosane	360
nC-28 Octacosane	300	nC-28 Octacosane	310
nC-29 Nonacosane	250	nC-29 Nonacosane	260
nC-30 Triacontane	230	nC-30 Triacontane	230
nC-31 Hentriacontane	150	nC-31 Hentriacontane	190
nC-32 Dotriacontane	120	nC-32 Dotriacontane	150
nC-33 Tritriacontane	100	nC-33 Tritriacontane	110
nC-34 Tetratriacontane	90	nC-34 Tetratriacontane	110
nC-35 Pentatriacontane	92	nC-35 Pentatriacontane	110
Total Alkanes	***30752***	***Total Alkanes***	***32940***

LSU ID#: 2010133-02 **Source Oil** **Sample Weight:** 310 mg **Final Extracted Volume:** 30 mL		**LSU ID#: Lab Ref Oil** **South Louisiana Crude** **Sample Weight:** 500 mg **Final Extracted Volume:** 20 mL	
Aromatic Analyte:	Concentration (ng/mg)	Aromatic Analyte:	Concentration (ng/mg)
Naphthalene	750	Naphthalene	710
C1-Naphthalenes	1600	C1-Naphthalenes	1300
C2-Naphthalenes	2000	C2-Naphthalenes	1500
C3-Naphthalenes	1400	C3-Naphthalenes	1100
C4-Naphthalenes	690	C4-Naphthalenes	590
Fluorene	130	Fluorene	100
C1-Fluorenes	340	C1-Fluorenes	270
C2-Fluorenes	390	C2-Fluorenes	270
C3- Fluorenes	300	C3- Fluorenes	240
Dibenzothiophene	53	Dibenzothiophene	56
C1-Dibenzothiophenes	170	C1-Dibenzothiophenes	210
C2-Dibenzothiophenes	220	C2-Dibenzothiophenes	280
C3- Dibenzothiophenes	160	C3- Dibenzothiophenes	240
Phenanthrene	290	Phenanthrene	200
C1-Phenanthrenes	680	C1-Phenanthrenes	360
C2-Phenanthrenes	660	C2-Phenanthrenes	340
C3-Phenanthrenes	400	C3-Phenanthrenes	200
C4-Phenanthrenes	200	C4-Phenanthrenes	84
Anthracene	6.1	Anthracene	6.2
Fluoranthene	4.2	Fluoranthene	4.5
Pyrene	8.9	Pyrene	7.1
C1- Pyrenes	68	C1- Pyrenes	43
C2- Pyrenes	84	C2- Pyrenes	31
C3- Pyrenes	96	C3- Pyrenes	31
C4- Pyrenes	54	C4- Pyrenes	20
Naphthobenzothiophene	11	Naphthobenzothiophene	7.8
C-1 Naphthobenzothiophenes	48	C-1 Naphthobenzothiophenes	30
C-2 Naphthobenzothiophenes	37	C-2 Naphthobenzothiophenes	30
C-3 Naphthobenzothiophenes	22	C-3 Naphthobenzothiophenes	25
Benzo (a) Anthracene	5.5	Benzo (a) Anthracene	5.4
Chrysene	36	Chrysene	14
C1- Chrysenes	100	C1- Chrysenes	28
C2- Chrysenes	100	C2- Chrysenes	27
C3- Chrysenes	54	C3- Chrysenes	18
C4- Chrysenes	19	C4- Chrysenes	5.6
Benzo (b) Fluoranthene	2.3	Benzo (b) Fluoranthene	1.7
Benzo (k) Fluoranthene	1.8	Benzo (k) Fluoranthene	1.5
Benzo (e) Pyrene	6.6	Benzo (e) Pyrene	2.9
Benzo (a) Pyrene	1.0	Benzo (a) Pyrene	1.0
Perylene	0.92	Perylene	0.89
Indeno (1,2,3 - cd) Pyrene	0.20	Indeno (1,2,3 - cd) Pyrene	0.22
Dibenzo (a,h) anthracene	1.3	Dibenzo (a,h) anthracene	0.92
Benzo (g,h,i) perylene	1.2	Benzo (g,h,i) perylene	1.1
Total Aromatics	***11203***	***Total Aromatics***	***8394***

2010133-02 (Source Oil, Pre-spill) – TIC



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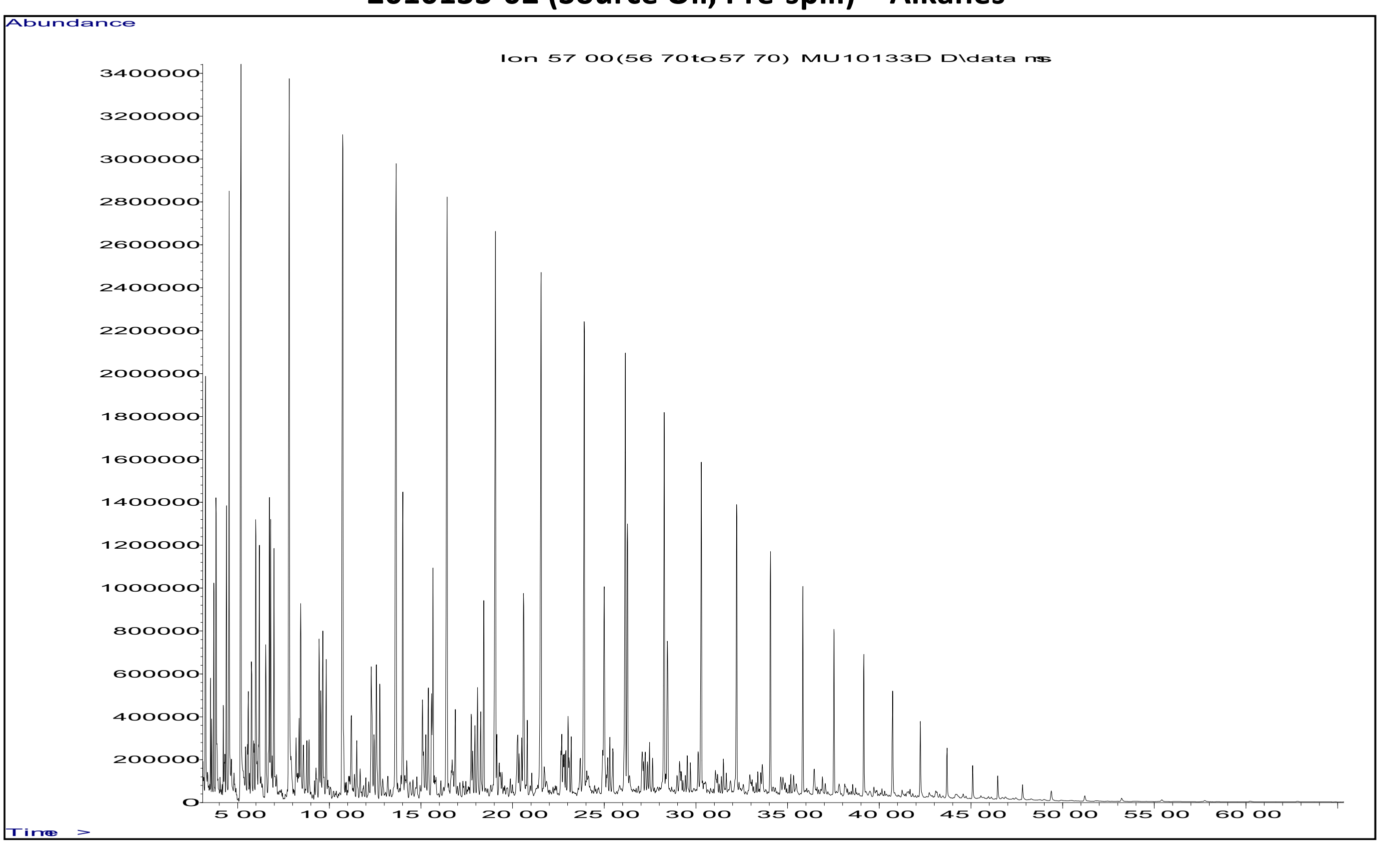
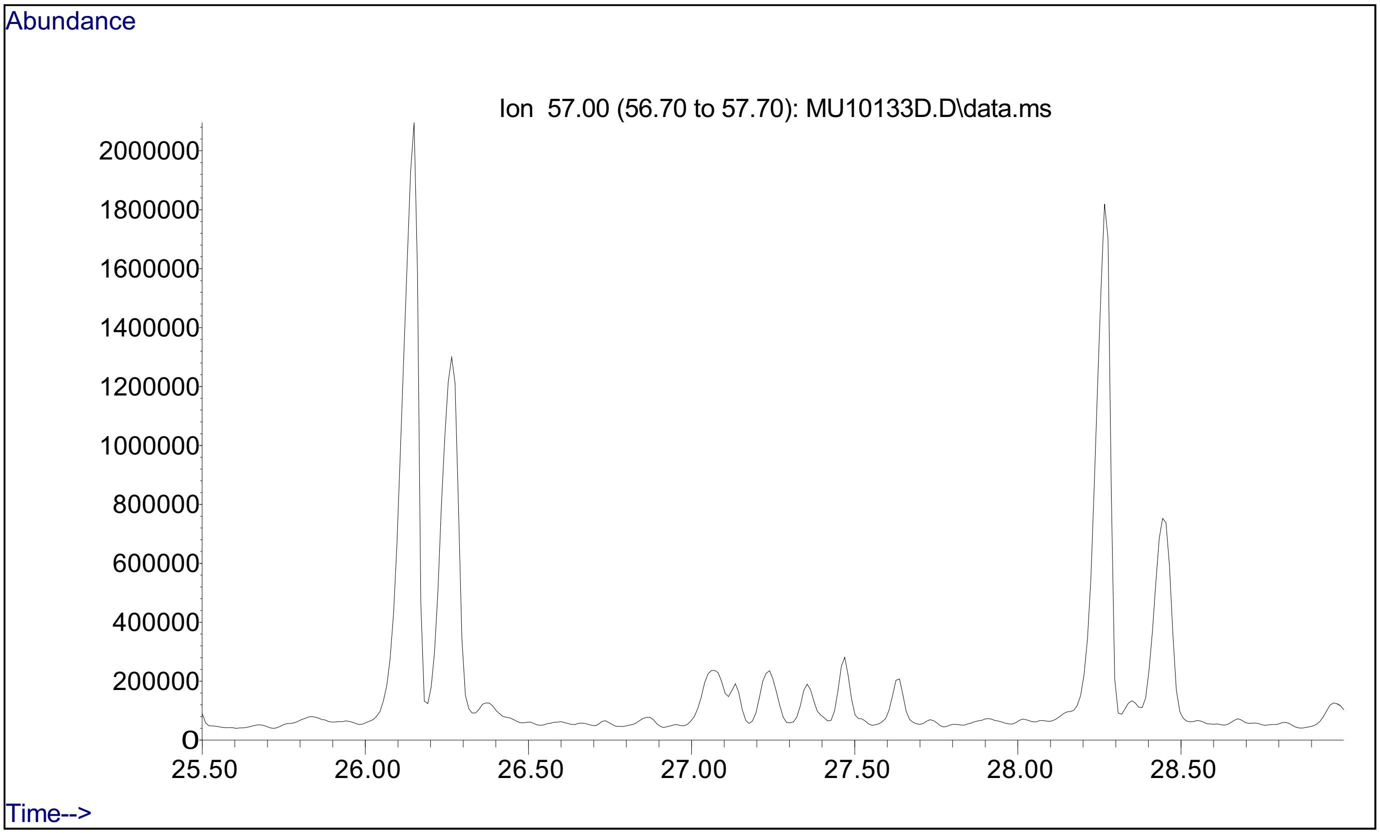


2010133-02 (Source Oil, Pre-spill) – C_{17}/Pristane, C_{18}/Phytane



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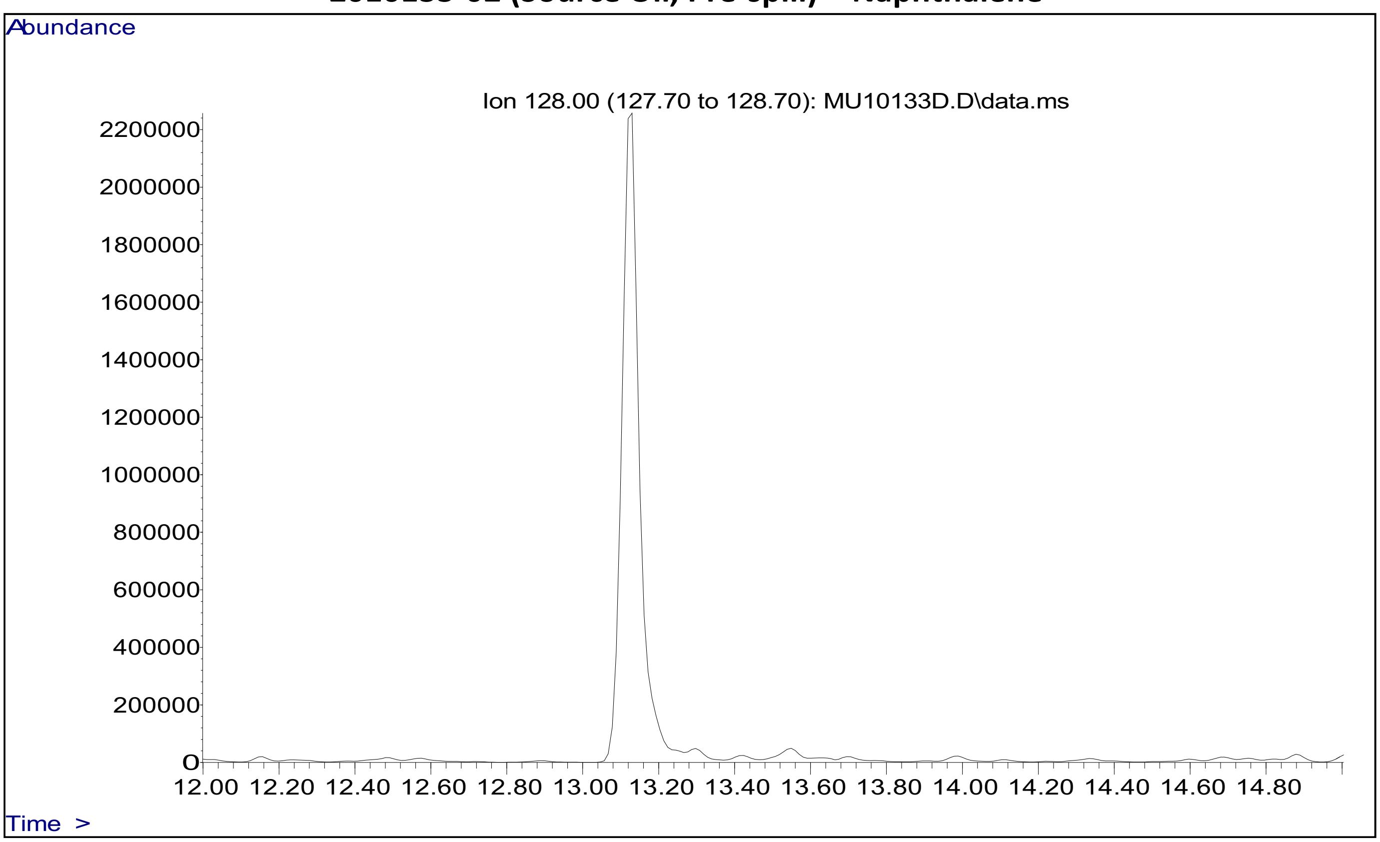

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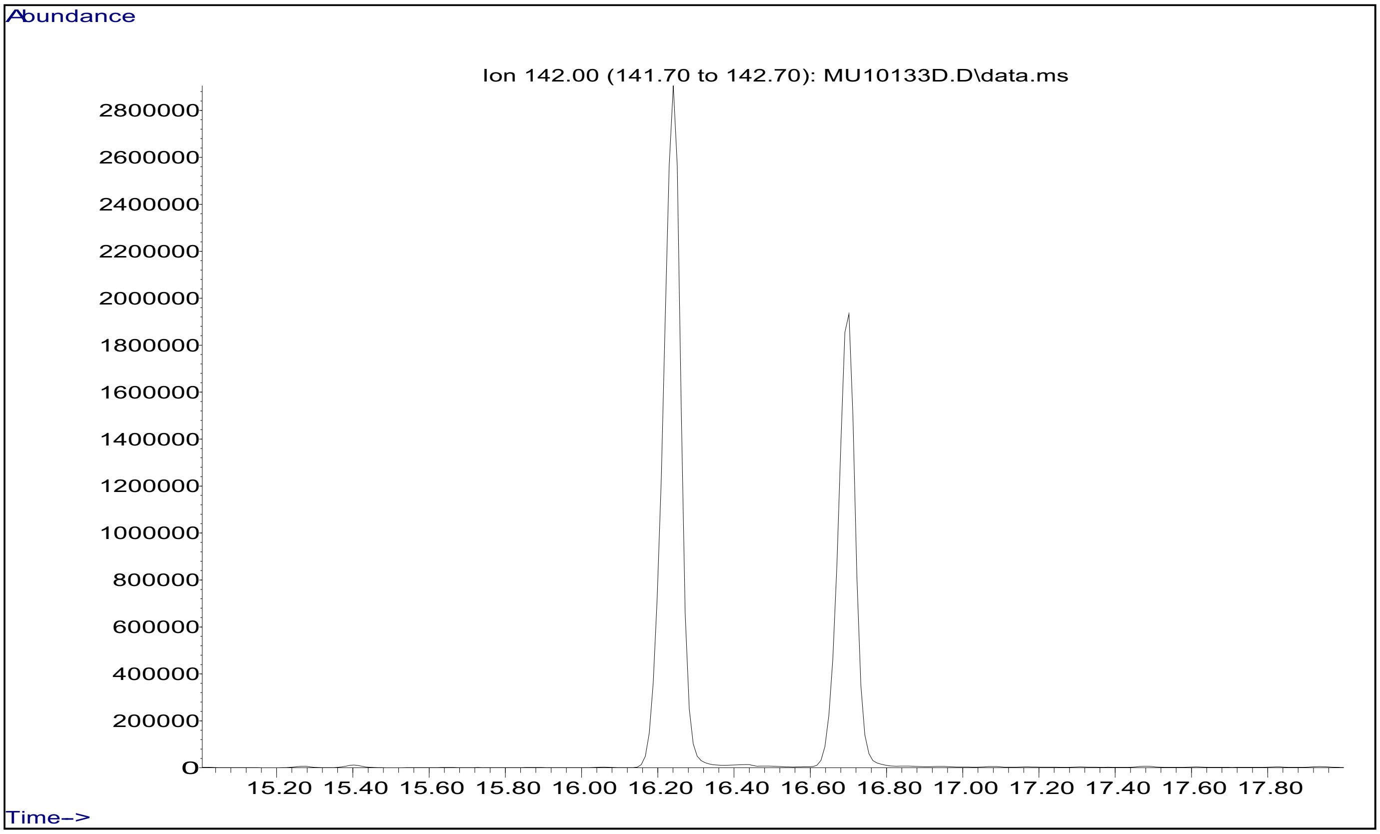

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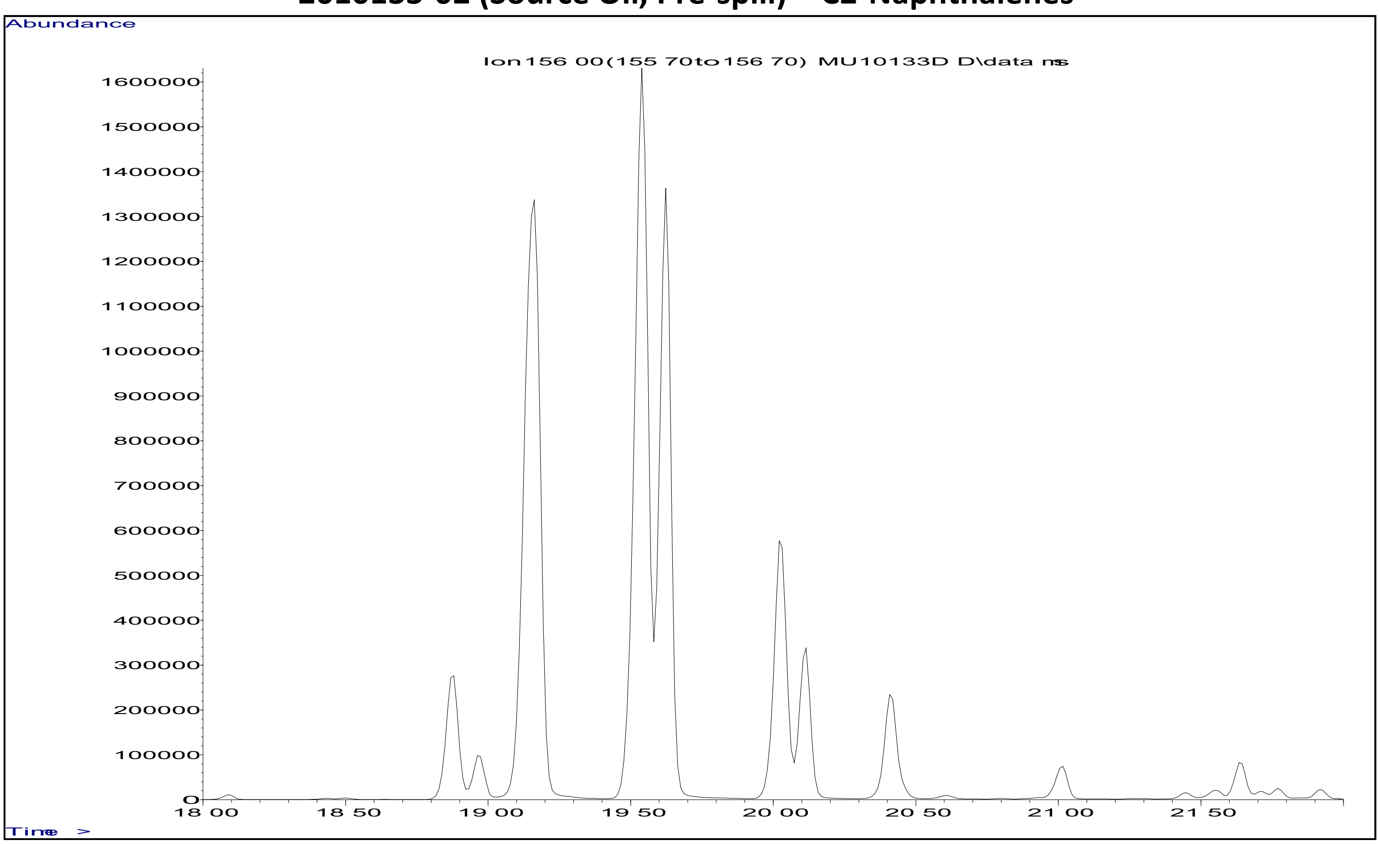

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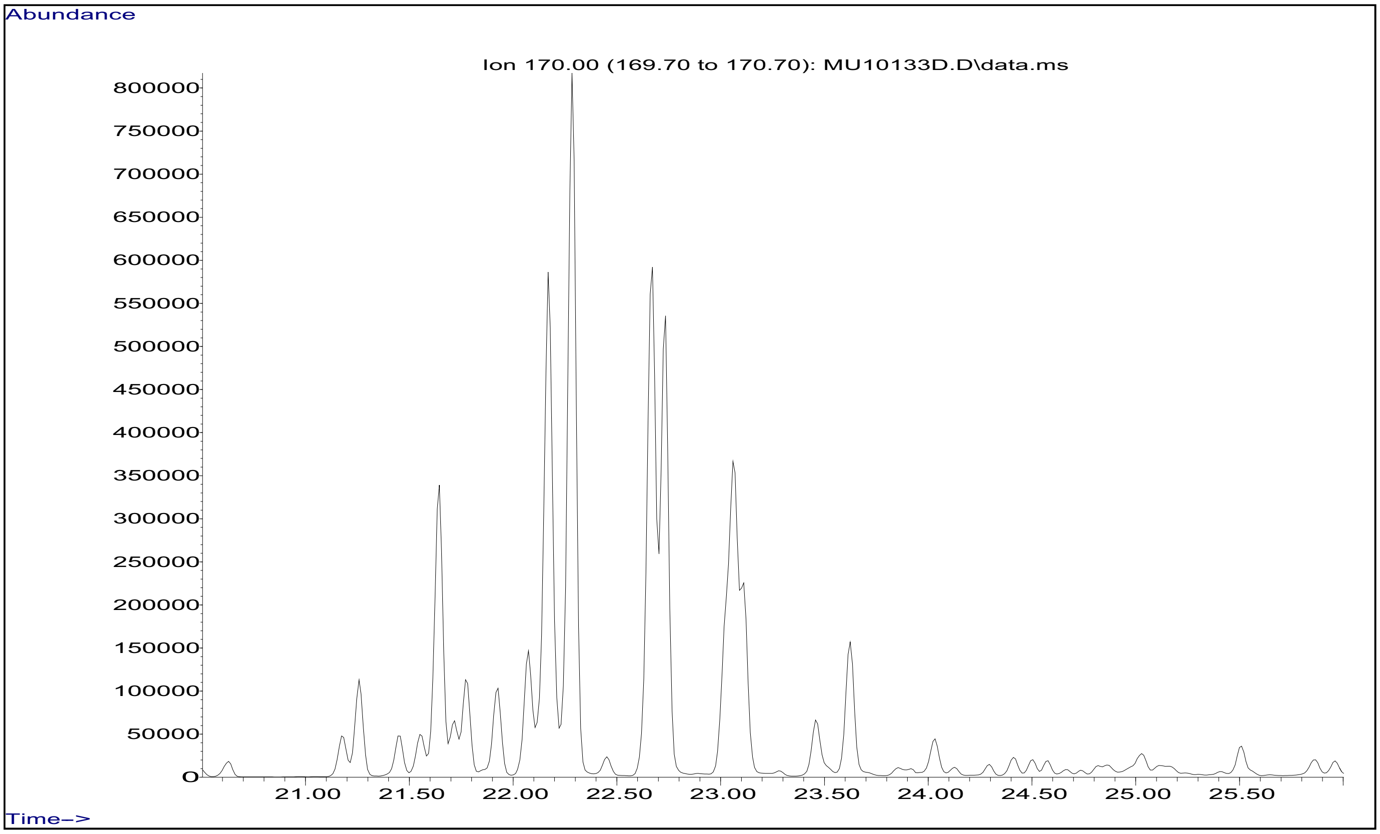

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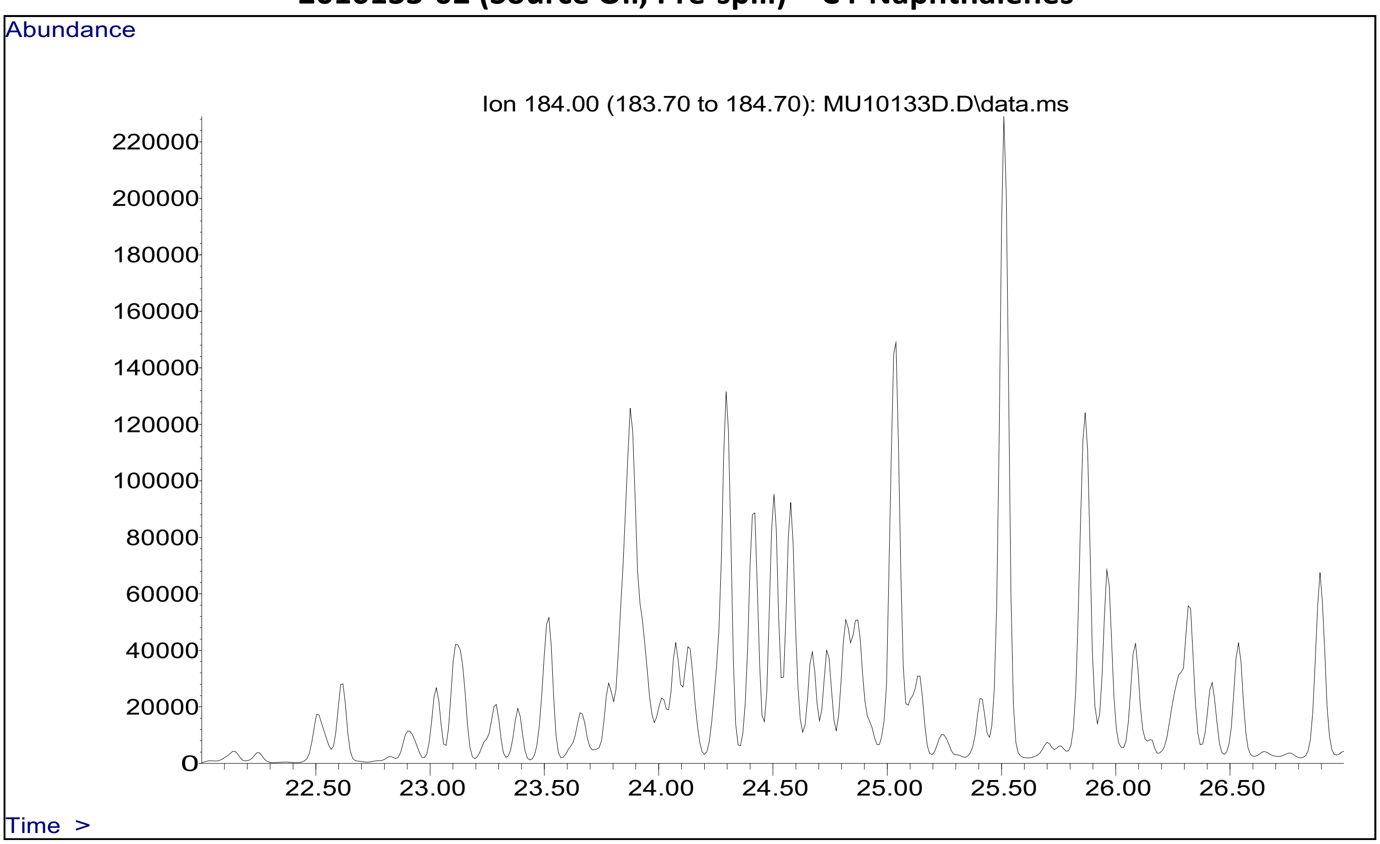
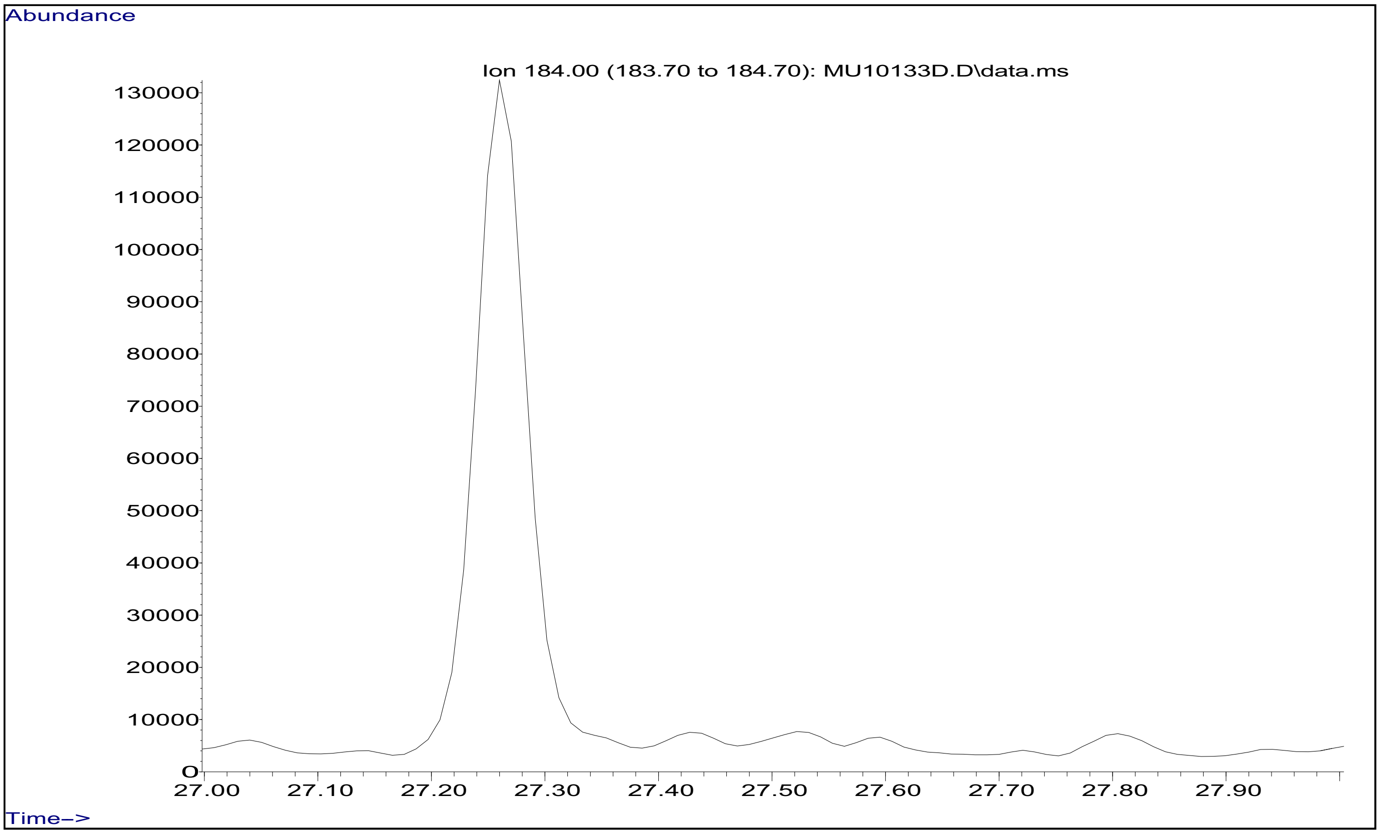


2010133-02 (Source Oil, Pre-spill) – DBT



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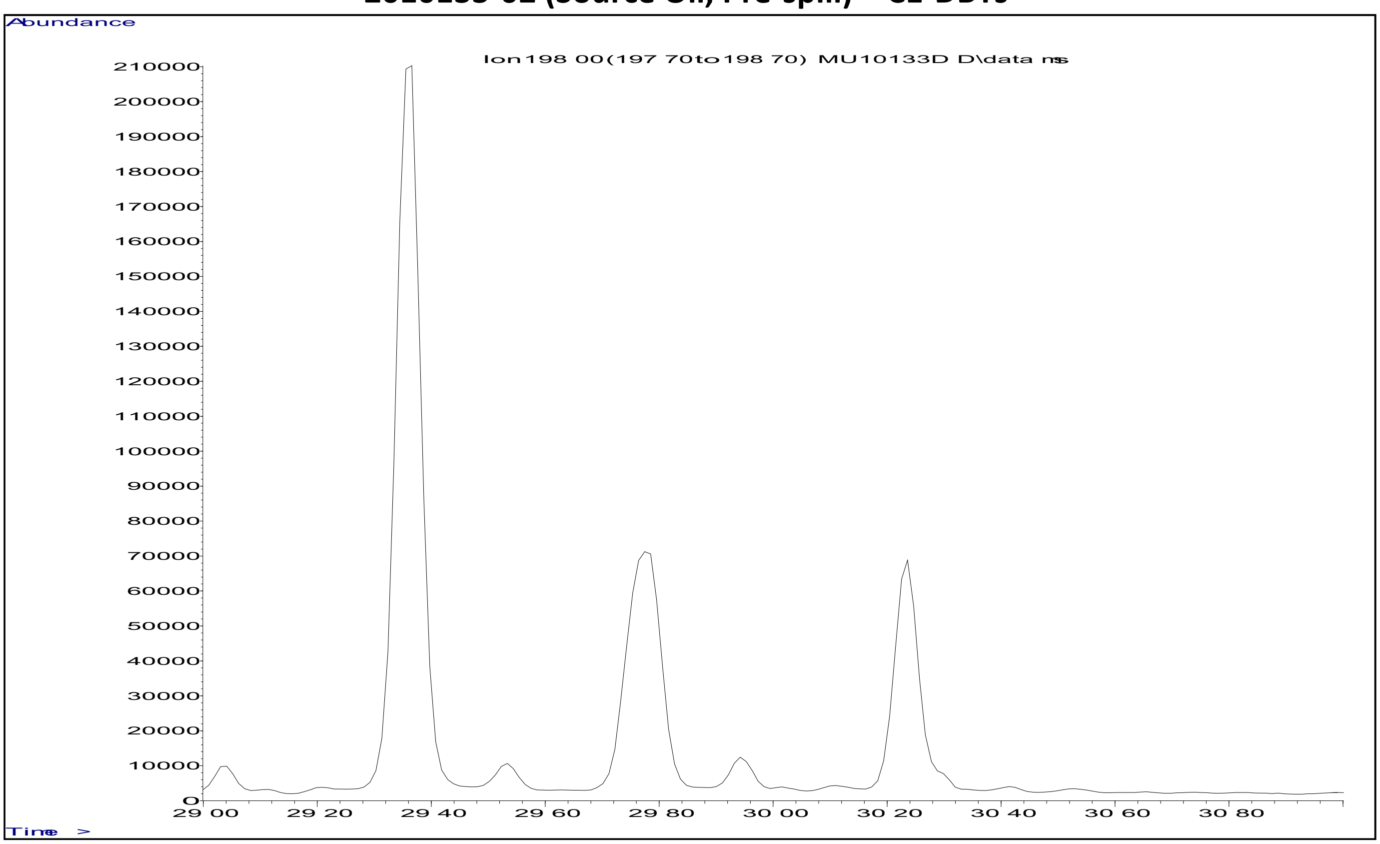

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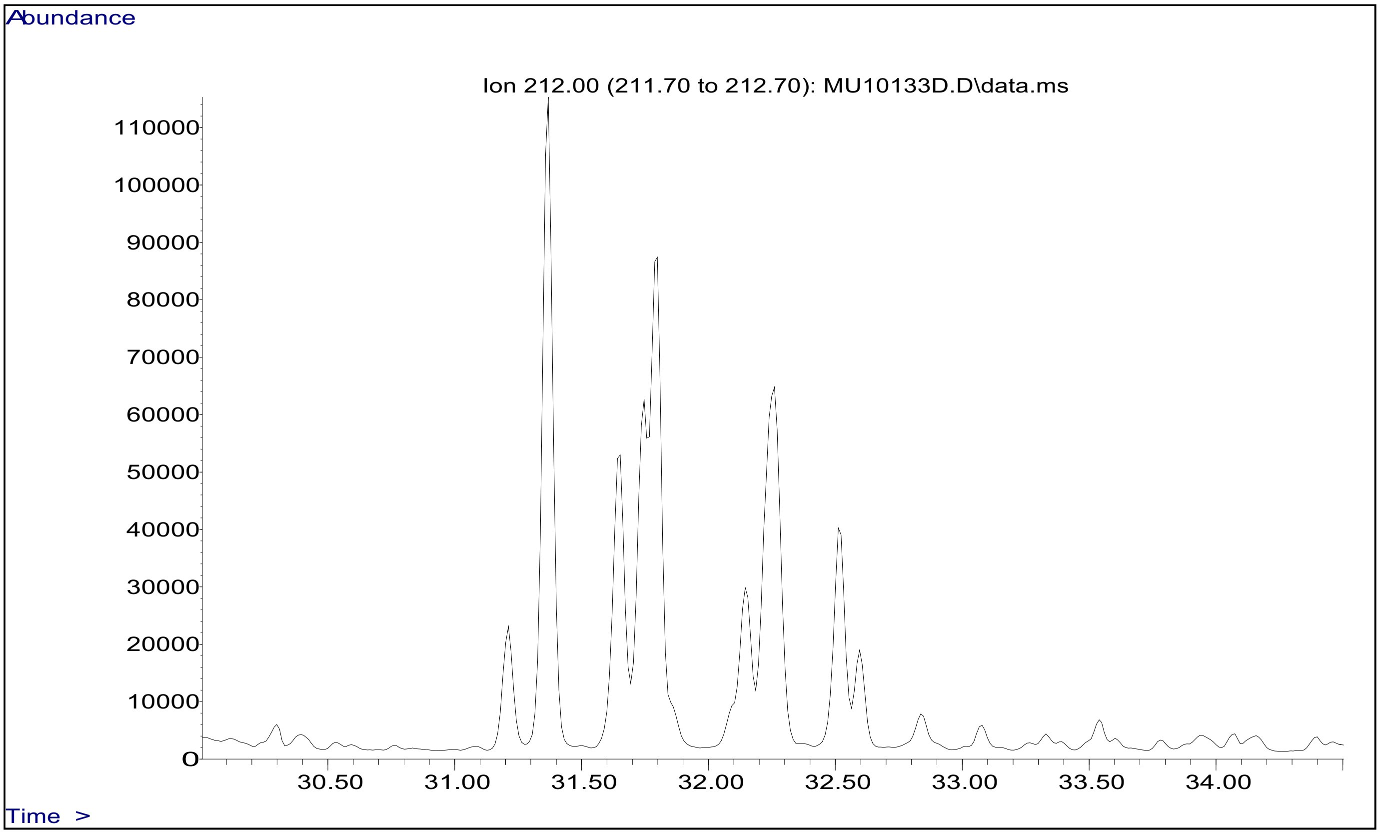

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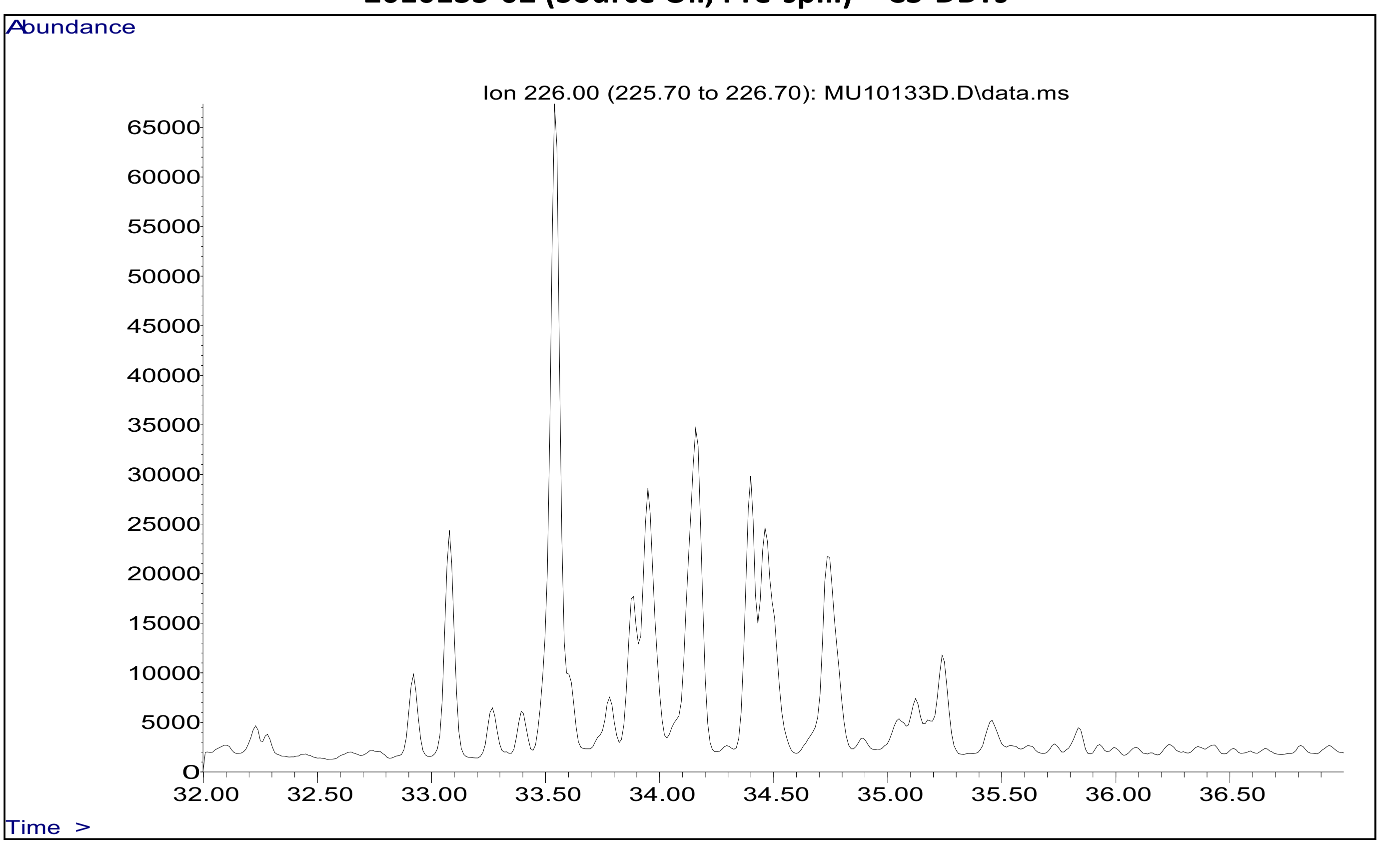

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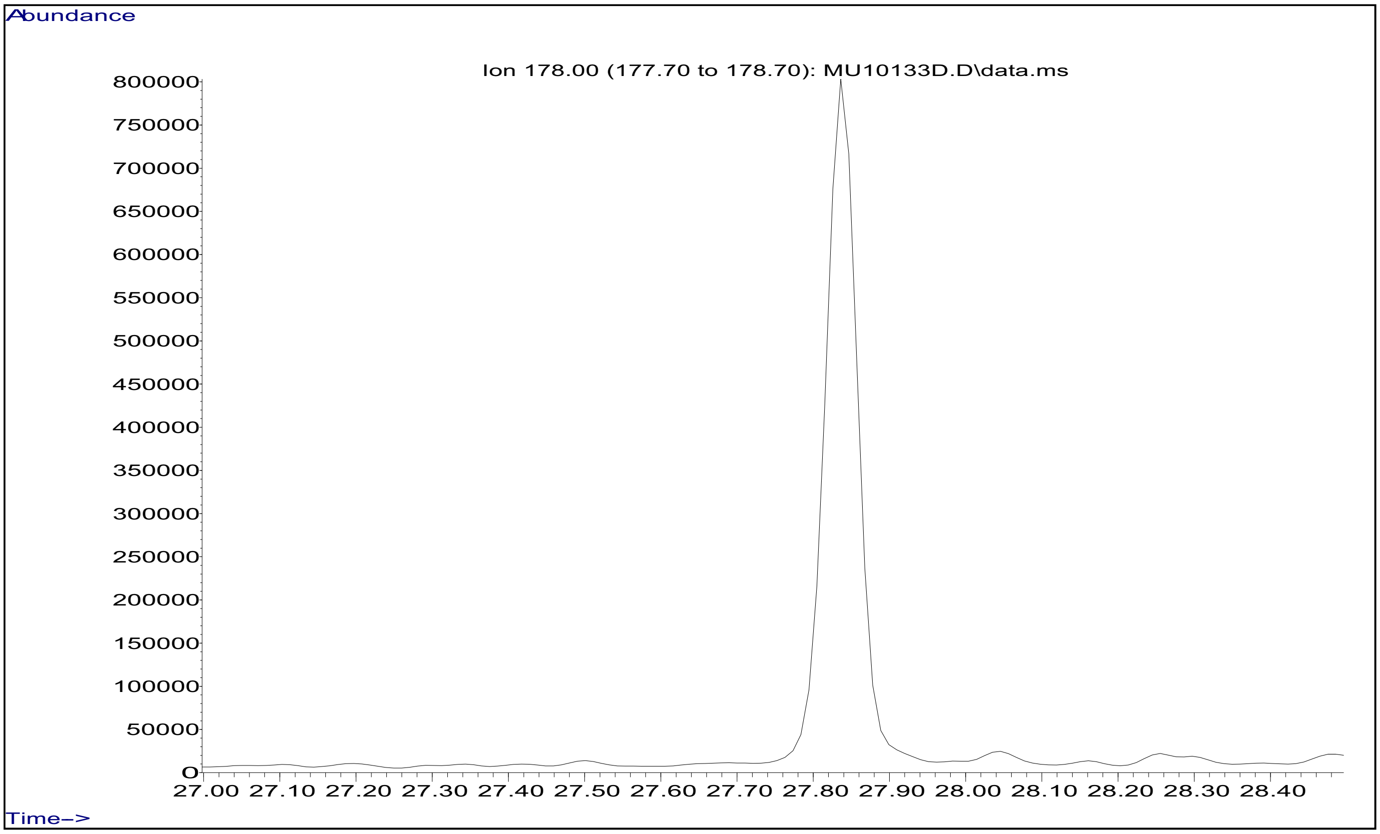

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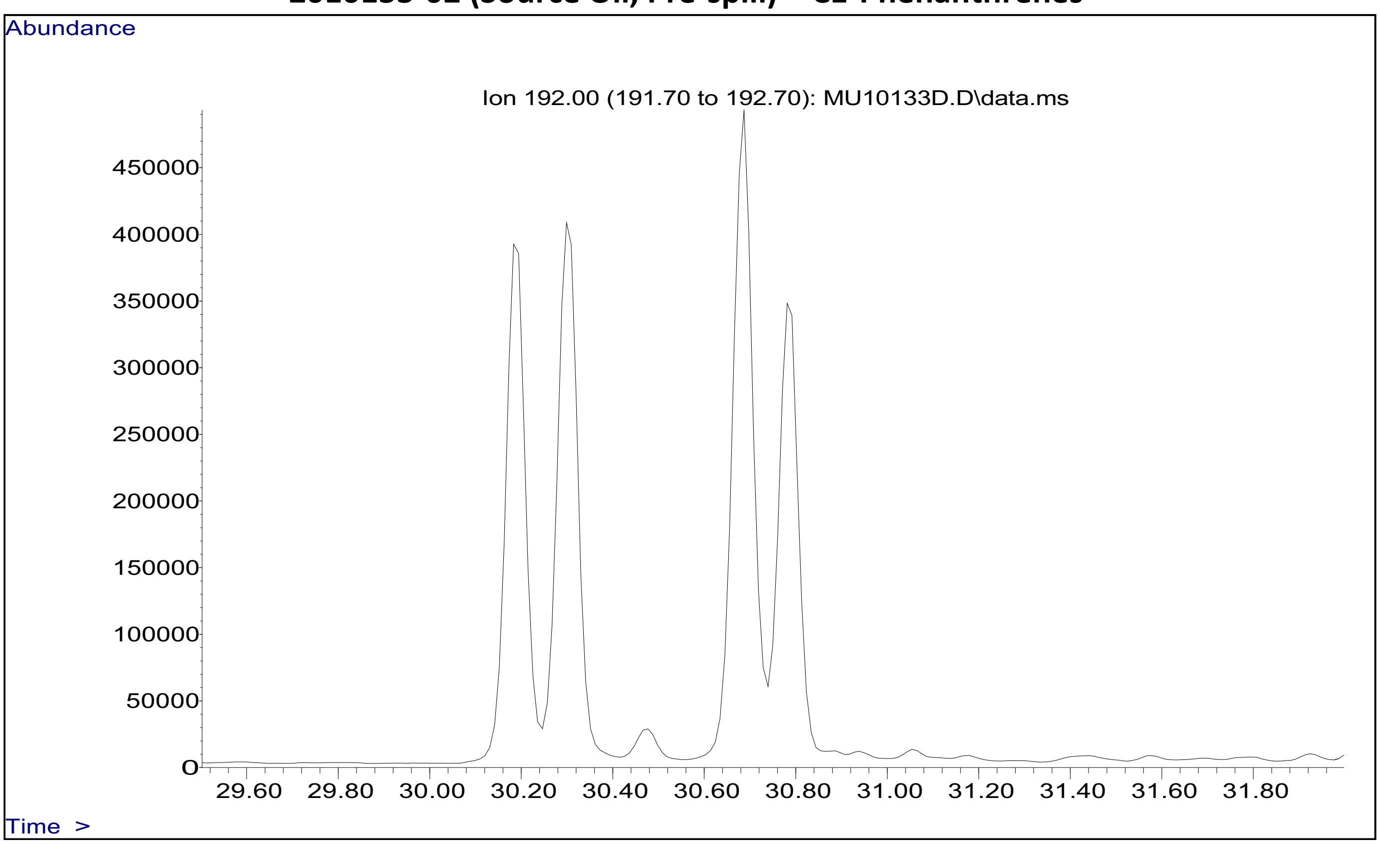

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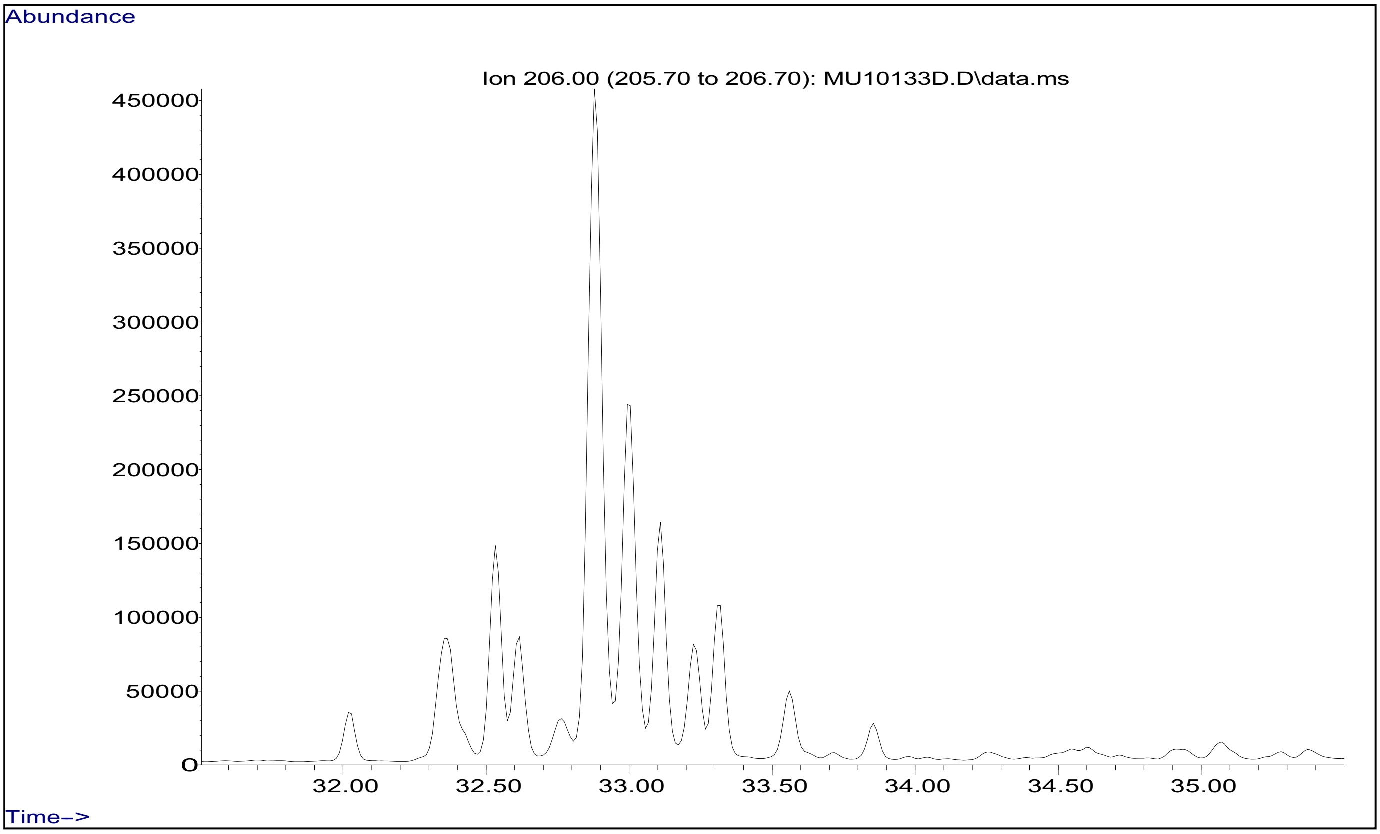

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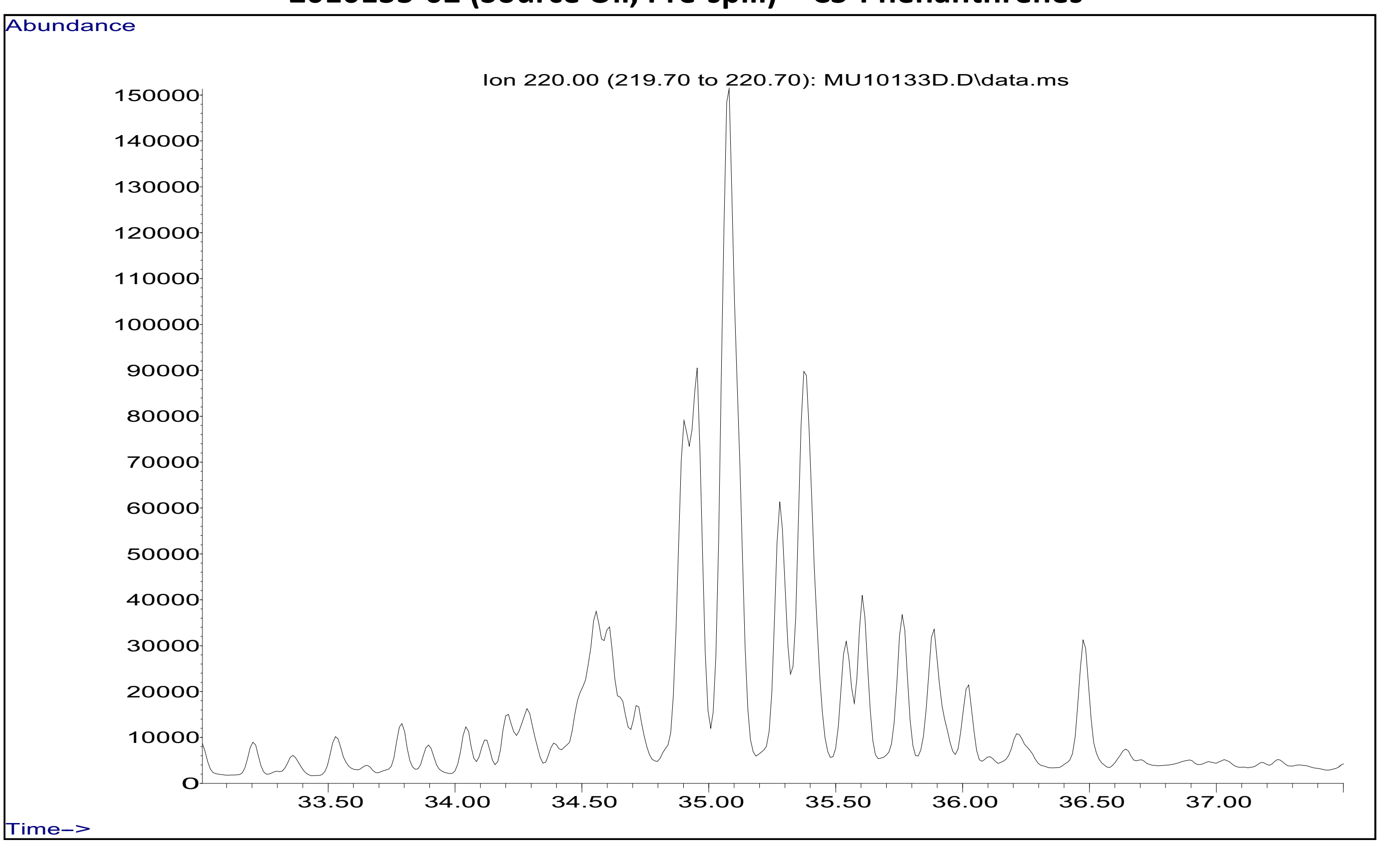
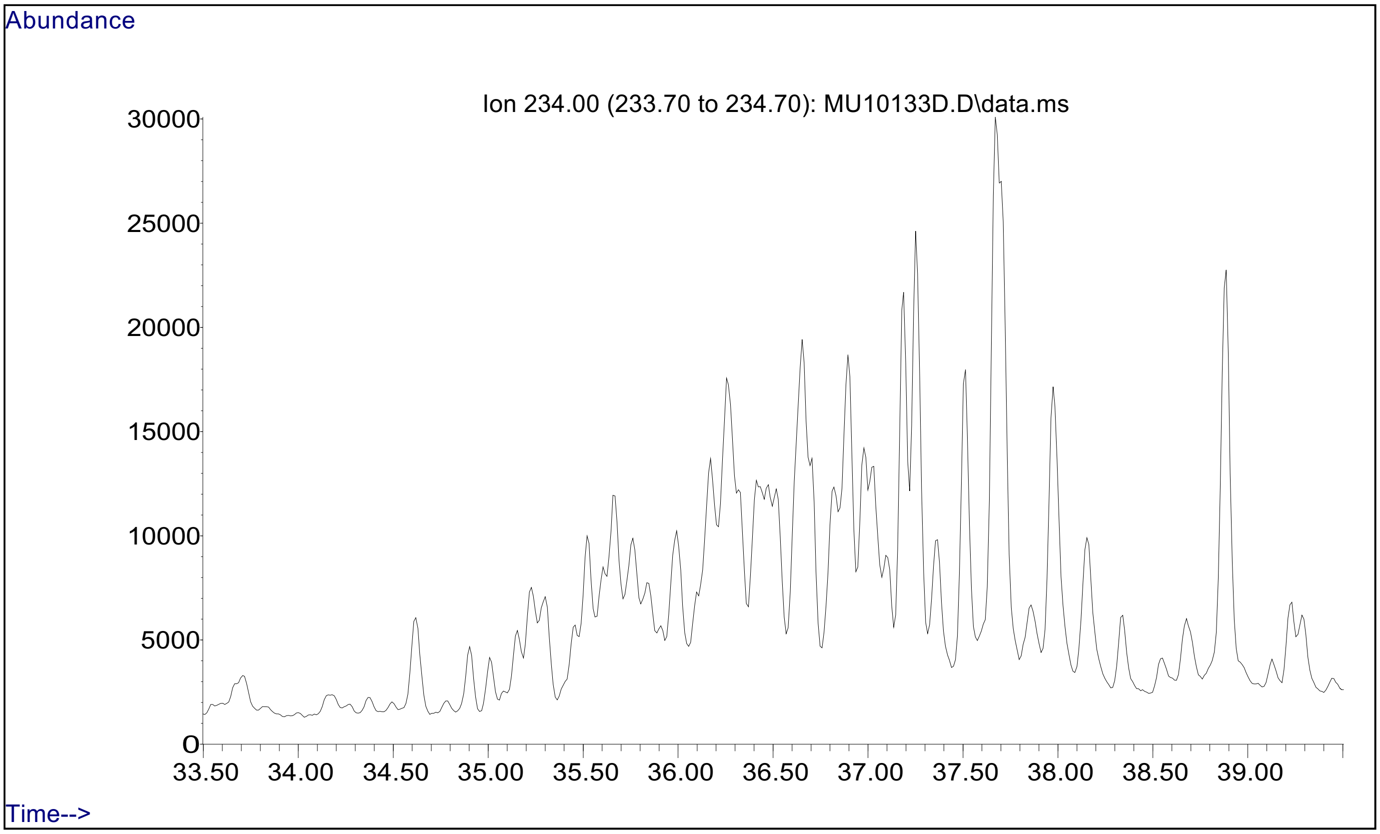


2010133-02 (Source Oil, Pre-spill) – C4-Phenanthrenes



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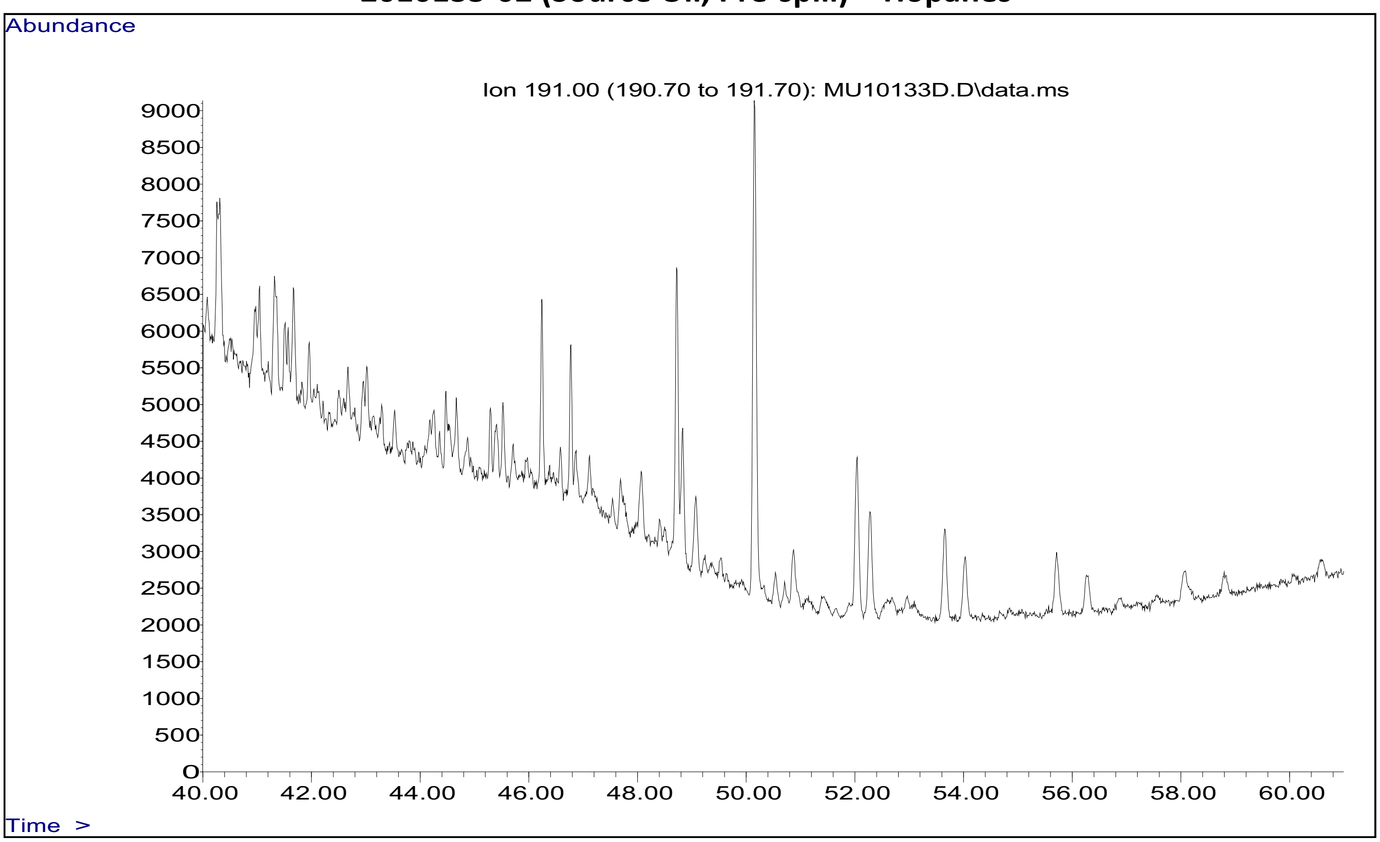

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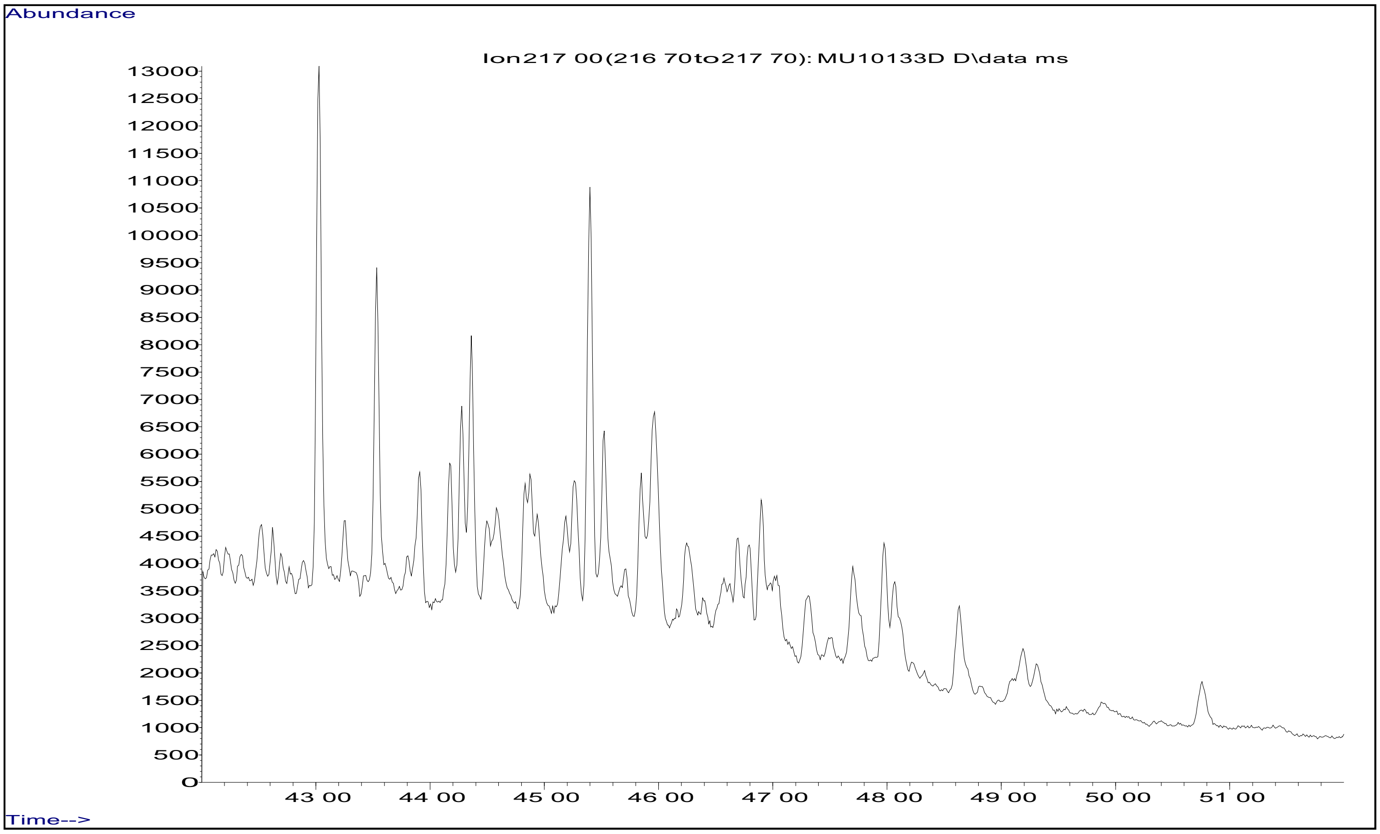

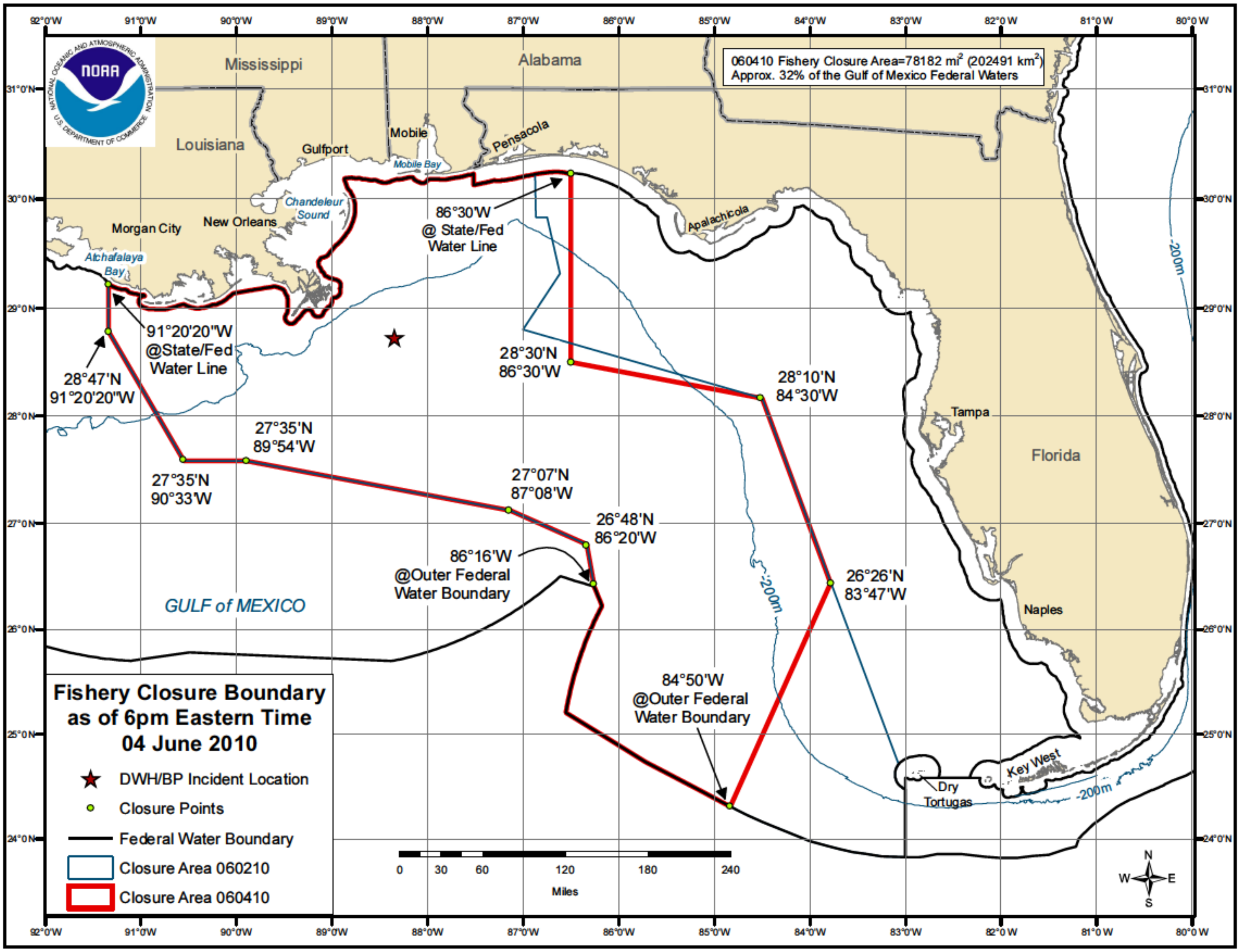

Document ID: 0.7.19.1935.2

Received(Date): Fri, 04 Jun 2010 17:29:58 -0400
From: Joe Inslee <Joe.Inslee@noaa.gov>
Subject: Cleared NRDA factsheets
To: Tom Brosnan <Tom.Brosnan@noaa.gov>
Cc: _HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>,Robert Haddad <Robert.Haddad@noaa.gov>, Brendan Bray <Brendan.Bray@noaa.gov>,Courtney Groeneveld <Courtney.Groeneveld@noaa.gov>,Mary Evans <Mary.Evans@noaa.gov>, Glenda Powell <Glenda.Powell@noaa.gov>,Vicki Loe <Vicki.Loe@noaa.gov>

Re: [Fwd: FW: DEEPWATER/Natural Resource Damage Assessment f

All-

These have been cleared (NOAA Comms ran the processing) and have been sent to Dave at the JIC and Vicki/Glenda for NOAA site.

Big thanks to all helped pull these together

-Joe

--
Joe Inslee
Policy/Outreach Assistant
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Received(Date): Fri, 04 Jun 2010 16:46:46 -0400
From: Courtney Groeneveld <Courtney.Groeneveld@noaa.gov>
Subject: Re: [Fwd: FW: DEEPWATER/Natural Resource Damage Assessment fact sheets]
To: Rachel Wilhelm <Rachel.Wilhelm@noaa.gov>

Sorry for the delay - I got a new laptop this afternoon and it took a while to transfer all my files. Here they are with edits.

Have a good weekend!

Courtney

Rachel Wilhelm wrote:

Subject:
FW: DEEPWATER/Natural Resource Damage Assessment fact sheets
From:
"Griffis, Kevin" <KGriffis@doc.gov>
Date:
Fri, 04 Jun 2010 11:21:41 -0400
To:
"Wilhelm, Rachel" <Rachel.Wilhelm@noaa.gov>, "Smullen, Scott" <Scott.Smullen@noaa.gov>, "Vaccaro, Christopher" <Christopher.Vaccaro@noaa.gov>
To:
"Wilhelm, Rachel" <Rachel.Wilhelm@noaa.gov>, "Smullen, Scott" <Scott.Smullen@noaa.gov>, "Vaccaro, Christopher" <Christopher.Vaccaro@noaa.gov>

From: Zaidi, Ali A. [mailto:Ali_A._Zaidi@omb.eop.gov]
Sent: Friday, June 04, 2010 11:20 AM
To: Griffis, Kevin
Cc: Adam.Fetcher@dhs.gov; Baer, Kenneth S.; Bedingfield, Katherine; Brian, Andrea M.; French, Michael J.; Greenawalt, Andrei M.; Kimball, Astri B.; LaBolt, Ben; Shapiro, Nicholas S.; Yates, Jonathan P.
Subject: FW: DEEPWATER/Natural Resource Damage Assessment fact sheets

Cleared with edits.

Thanks.

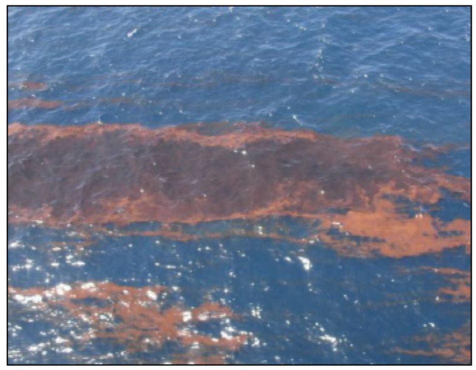
DAMAGE ASSESSMENT, REMEDIATION, & RESTORATION PROGRAM

DARRP

Office of Response and Restoration • Office of Habitat Conservation • General Counsel for Natural Resources

Oil Spills: NOAA Assessment and Restoration

Under the Oil Pollution Act of 1990, a Natural Resource Damage Assessment is the legal process to determine the type and amount of restoration needed to compensate the public for harm to natural resources as a result of an oil spill.



On April 22, 2010, the oil rig Deepwater Horizon MC252 sank off the coast of Louisiana, resulting in a leak of millions of gallons of oil from the well approximately a mile below the surface of the ocean.

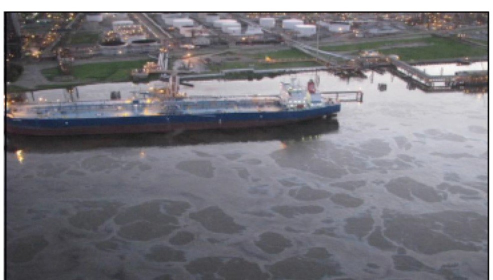
Key Facts

- NOAA Role? NOAA is a lead federal trustee for protection and restoration of coastal and marine natural resources, including marine and migratory fish, endangered species, marine mammals and their habitats.
- How Many Spills? NOAA responds to as many as 150 oil spills every year.
- Past Success? In response to oil spills, NOAA has restored thousands of acres of coastal habitat in the past 18 years.
- Who Benefits? Restoration of wetlands, coral and shellfish reefs, beaches and rivers benefit coastal communities that rely on vibrant fisheries and thriving wildlife for recreation, tourism, and food.

How We Work

NOAA works cooperatively with other natural resource trustees and, when possible, the parties responsible for the pollution. The Damage Assessment process promotes cost-effective assessment and restoration benefiting the public, the responsible parties, and the environment.





NOAA acts as a trustee on behalf of the public to restore coastal and marine resources injured by oil spills and hazardous substance releases and vessel groundings.

After an Oil Spill: What Happens Next?

During and after an oil spill, there are three main steps to restore impacted areas:

- Preassessment: Determine whether injury to natural resources has occurred. Work includes collecting time-sensitive data, reviewing scientific literature about the oil and its impact on coastal resources and determining the extent and severity of injury.
- Injury Assessment and Planning: Scientific and economic studies assess and quantify the injuries and the loss of services. A restoration plan is developed to identify restoration projects.
- Restoration: Work with the public and responsible party to select, implement, and monitor restoration projects. The responsible parties pay for assessment and restoration costs.

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Deepwater Horizon Oil Spill: NOAA Assessment and Restoration

On April 20, an explosion on the Deepwater Horizon MC252 drilling platform in the Gulf of Mexico caused the rig to sink and oil began leaking into the Gulf. This significant spill poses a serious threat to wildlife and the fishing community along the large coastal areas of Louisiana, Mississippi, Texas, Alabama, and Florida. Although it will be months before the full extent of the damage will be known, the spill is impacting the Gulf coastline, and NOAA is acting quickly to begin preliminary assessments and plan for restoration along the coast.

NOAA's Role

To help determine the type and amount of restoration needed to compensate the public for harm to natural resources as a result of the spill, a Natural Resource Damage Assessment will be conducted by NOAA. Although many agencies are involved in this process, NOAA is a lead federal trustee for coastal and marine natural resources, including marine and migratory fish, endangered species, marine mammals and their habitats.

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Vessel skimming oil from the Deepwater Horizon.

Early response to the explosion (photo courtesy U.S. Coast Guard).

Potential Impacts of the Deepwater Horizon Spill

The oil spill is impacting Louisiana's shoreline habitats and fisheries, as well as current and completed restoration projects on the coast.

- Fisheries: During past oil spills in the Gulf of Mexico, NOAA has documented direct toxic impacts to commercially important aquatic life including blue crabs, squid, shrimp and a variety fish species. Toxins in the oil can kill these species or have other harmful effects such as: genetic damage, liver disease, cancer, and reproductive, developmental, and immune system impairment in fish and other organisms.
- Habitat: The presence of discharged oil in the environment may cause decreased habitat use in the area, altered migration patterns, altered food availability, and disrupted life cycles. Oiled plants could die, eliminating the roots that help bind and stabilize soil, leading to erosion.
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Oil in Louisiana wetlands during the Deepwater Horizon Oil Spill, May 2010. Although it will take months to understand the full extent of the impact, NOAA staff are working through preliminary assessments as part of its efforts as a Natural Resource Damage Assessment trustee.

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NOAA Administrator Dr. Jane Lubchenco, NOAA Fisheries Assistant Administrator Eric Schwaab, and Council on Environmental Quality Chair Nancy Sutley assess how the sample is processed aboard the Research Vessel Caretta and the chain of custody protocol used when handling specimens associated with the oil spill.

For further information about DARRP, please visit
http://www.darrp.noaa.gov

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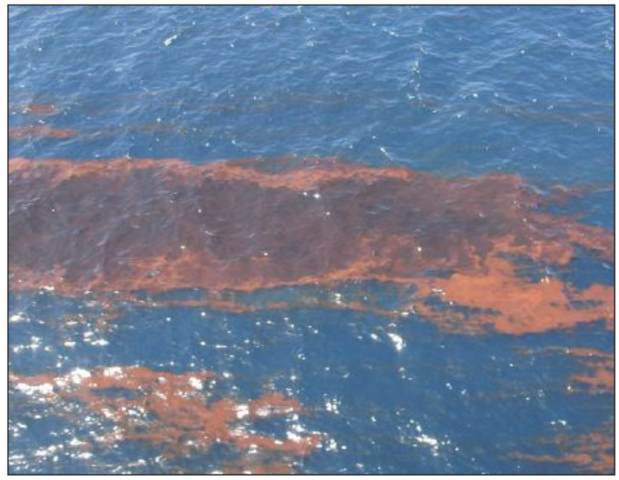

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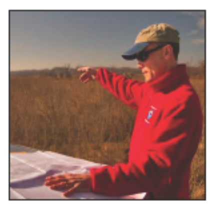

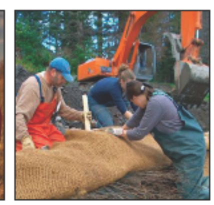

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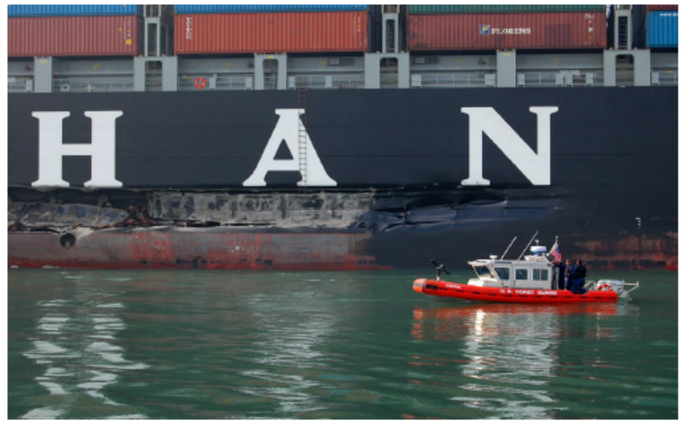
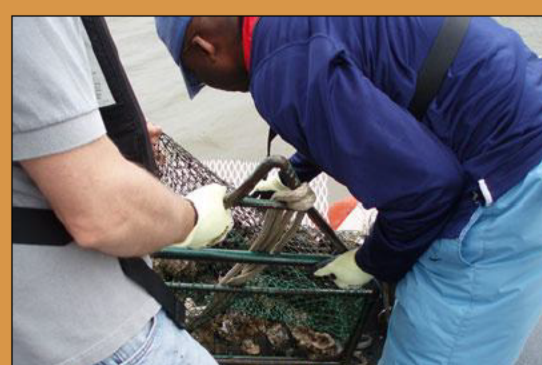
Five Notable Oil Spills of Recent Years

- **British Petroleum Deepwater Horizon MC252 Rig, Louisiana:** On Earth Day, April 22, 2010, an oil rig in the Gulf of Mexico sank after suffering damages from an explosion and fire two days prior. Millions of gallons of oil have leaked from the well approximately a mile below the surface of the ocean. Preliminary assessments have begun, but response is still underway. It could be months or years before the full extent of the injuries are known. However, some restoration actions will likely occur in the short-term, to speed known resource injuries toward recovery, while other restoration activities can only be implemented once the full suite of natural resource losses are considered and appropriate restoration options are selected. NOAA is concerned about ongoing and long-term impacts to fish, shellfish, marine mammals, turtles, birds, and other sensitive resources as well as their habitats, including wetlands, beaches, mudflats, bottom sediments, corals, and the water column.
- **Barge DM932 and Tintomara, Louisiana:** In July 2008, the chemical tank ship Tintomara collided with the American Commercial Lines barge DM932 near downtown New Orleans, resulting in a spill of 270,000 gallons of oil. Cleanup of the incident took several months. Injuries are being assessed.
- **Cosco Busan, California:** In November 2007, the container ship M/V Cosco Busan struck the San Francisco-Oakland Bay Bridge in San Francisco Bay and tore a large gash in the hull of the vessel, and 53,000 gallons of fuel oil were released into the water. The oil spread along many miles of sensitive coastline, including beaches, rocky intertidal habitats, coastal lagoons, and wetlands.
- **Chalk Point, Maryland:** On April 7, 2000, a leak was detected in an underground pipeline that supplies oil to the Potomac Electric Power Company Chalk Point generating station in Aquasco, Maryland. Approximately 140,000 gallons of fuel oil spilled into Swanson Creek, and about 40 miles of envrionmentally-sensitive downstream creeks and shorelines were oiled as a result. This case was settled in 2002, and the trustees have undertaken a series of restoration projects to address natural resource and lost use injuries associated with the fuel pipeline leak.
- **Athos Spill, Delaware, New Jersey and Pennsylvania:** In November 2004, the M/T Athos I struck a large, submerged anchor while preparing to dock at a refinery in Paulsboro, New Jersey. The anchor punctured the vessel's bottom, resulting in the discharge of nearly 265,000 gallons of crude oil into the Delaware River and nearby tributaries. Injuries are being assessed. The claim has been submitted to the National Pollution Fund Center for adjudication.



Hole in the Cosco Busan container ship, which spilled 53,000 gallons of oil in San Francisco Bay in 2007.

Deepwater Horizon Spill: Assessing Impacts to Gulf of Mexico Fisheries and Coastal Wetlands



Left: NOAA Administrator Dr. Jane Lubchenco, NOAA Fisheries Assistant Administrator Eric Schwaab, and Council on Environmental Quality Chair Nancy Sutley assess how the sample is processed aboard the Research Vessel Caretta and chain of custody protocol used when handling specimens associated with the oil spill. Right: Scientist Dr. Dennis Apeti, brings up a trawl full of oysters for testing.

For further information about DARRP, please visit
http://www.darrp.noaa.gov

Received(Date): Fri, 04 Jun 2010 17:47:05 -0400
From: Rachel Wilhelm <Rachel.Wilhelm@noaa.gov>
Subject: Deepwater NRDA Fact Sheet
To: Oil_DWH <dwh.staff@noaa.gov>

Being posted on NOAA site and JIC.

Rachel

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Rachel A. Wilhelm
NOAA Public Affairs Specialist
Office: 202.482.3978
Mobile: 202.657.9816
Email: Rachel.Wilhelm@noaa.gov

http://www.noaa.gov
http://www.climate.gov

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Early response to the explosion (photo courtesy U.S. Coast Guard).

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Received(Date): Sat, 05 Jun 2010 06:16:56 -0400
From: ICC Deputy <ICC.Deputy@noaa.gov>
Subject: DEEPWATER HORIZON - morning reports
To: Deepwater.HorizonDist@noaa.gov
LoopCurrentStatus-6-04.pdf
loopcurrent_6_4.pdf
os_forecast_20100607_1200CDT_20100604_1900CDT_rs.pdf
forecast_20100607_1200CDT_20100604_2100CDT_rs.pdf
landfall6_04.pdf
Deepwater_Horizon_Report_48.pdf

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ICC Deputy on Watch
ICC Main Number: (301) 713-0136

TIME: 8:00pm CDT, June 4, 2010
TO: NOAA SSCs
FROM: NOAA Office of Response and Restoration / Emergency Response Division
Seattle, WA 98115

SUBJECT: Deepwater Horizon MC252 incident and the Loop Current

Summary The pattern continues to show minimal risk of the Loop Current serving as a significant mechanism to transport oil toward any shorelines. There continue to be no significant amounts of oil being moved toward the Loop Current. However, there continues to be persistent sheens in the northern parts of the warm core ring that is detached (or nearly so) from the Loop Current. The anomaly that has been observed by satellite analysis on the outside of the eddy on the eastern side was no longer visible in satellite analysis for the last two days. There has been no evidence of high concentrations of oil in or near the Loop Current.

The northern eddy is showing signs of re-attaching to the main Loop Current. It is expected to re-form over the next few days to a week. Depending on which model you use, there either is or isn't a connection to the main Loop Current on the southwestern side of the warm core eddy. Buoys dropped in the Loop Current earlier this week and last week are consistent with the models showing the northern eddy as separated. In addition, some of the models indicate a pathway from the far eastern edge of the main eddy to the Florida Current, and passing through the Florida Straits. Two additional buoys were dropped a few days ago. We continue to monitor the situation closely.

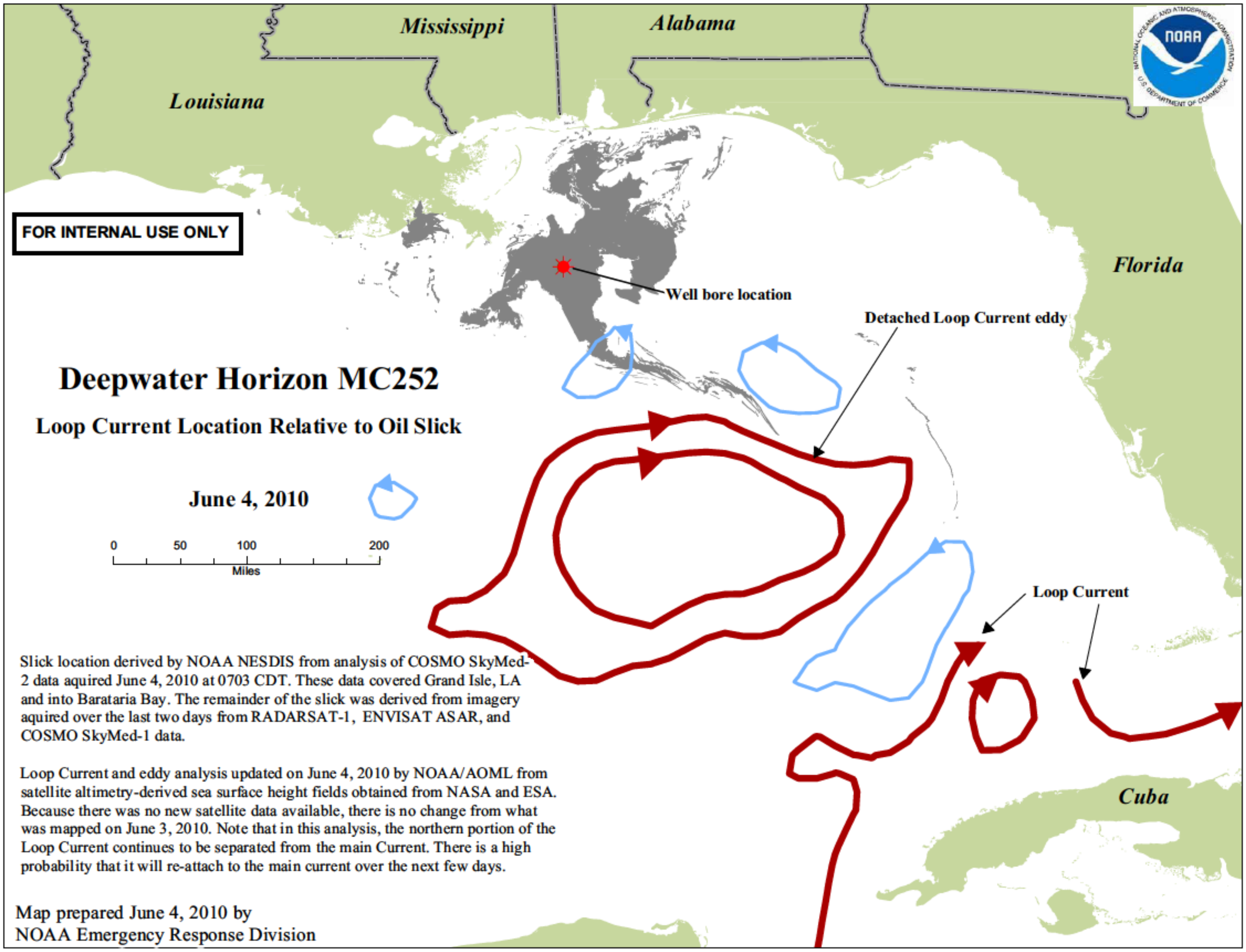
The sheens observed in the overflight two days ago are not likely to reach the Florida Straits in the next 3-4 days. Any oil ultimately making it to the Florida Straits will likely consist of widely scattered tarballs. At this time, we estimate that the fraction that may reach shorelines may be slightly above background levels of tarballs already on the Florida shorelines.

How we are monitoring We continue to monitor the Loop Current characteristics from a number of satellite and model sources, a vessel contracted by BP to monitor at the northern front, and buoys dropped in or near the Loop Current over the last two weeks.

The sheen that has been pulled toward the Loop Current continues to be stretched out and thinned. A NOAA overflight two days ago (Wesley) observed some 2 to 4 foot pancakes at 1-2% coverage about 40 miles from the edge of the Loop current. Beyond that there was some transparent sheen that was breaking up as it got nearer to the Loop Current.

Light sheen on the leading edges of slicks may be accompanied by tarballs that are generally not visible from fixed wing aircraft or satellite observations. Shipboard monitoring coordinated with aerial positioning is the best method to determine if there are tarballs associated with this surface sheen. We have no confirmation that a ship has been secured for this mission.

What can be expected in the future It is likely that at some point in the future, another fraction of the oil will move south from the spill site. If this oil gets entrained into the northern eddy while it is still separated, the oil will tend to remain in the eddy, circulating around the middle of the Gulf, far from shore, as it continues to weather and dissipate. However, when this large eddy reconnects with the main Loop, any oil moved to the northern extent of the Current will once again have a pathway to the Florida Straits and beyond. We will continue daily monitoring of the Loop Current in order to monitor this re-connection.


Mississippi
Alabama
Louisiana
FOR INTERNAL USE ONLY
Florida
Well bore location
Detached Loop Current eddy
Deepwater Horizon MC252
Loop Current Location Relative to Oil Slick
June 4, 2010
0 50 100 200
Miles
Loop Current
Cuba
Slick location derived by NOAA NESDIS from analysis of COSMO SkyMed-2 data aquired June 4, 2010 at 0703 CDT. These data covered Grand Isle, LA and into Barataria Bay. The remainder of the slick was derived from imagery aquired over the last two days from RADARSAT-1, ENVISAT ASAR, and COSMO SkyMed-1 data.
Loop Current and eddy analysis updated on June 4, 2010 by NOAA/AOML from satellite altimetry-derived sea surface height fields obtained from NASA and ESA. Because there was no new satellite data available, there is no change from what was mapped on June 3, 2010. Note that in this analysis, the northern portion of the Loop Current continues to be separated from the main Current. There is a high probability that it will re-attach to the main current over the next few days.
Map prepared June 4, 2010 by
NOAA Emergency Response Division

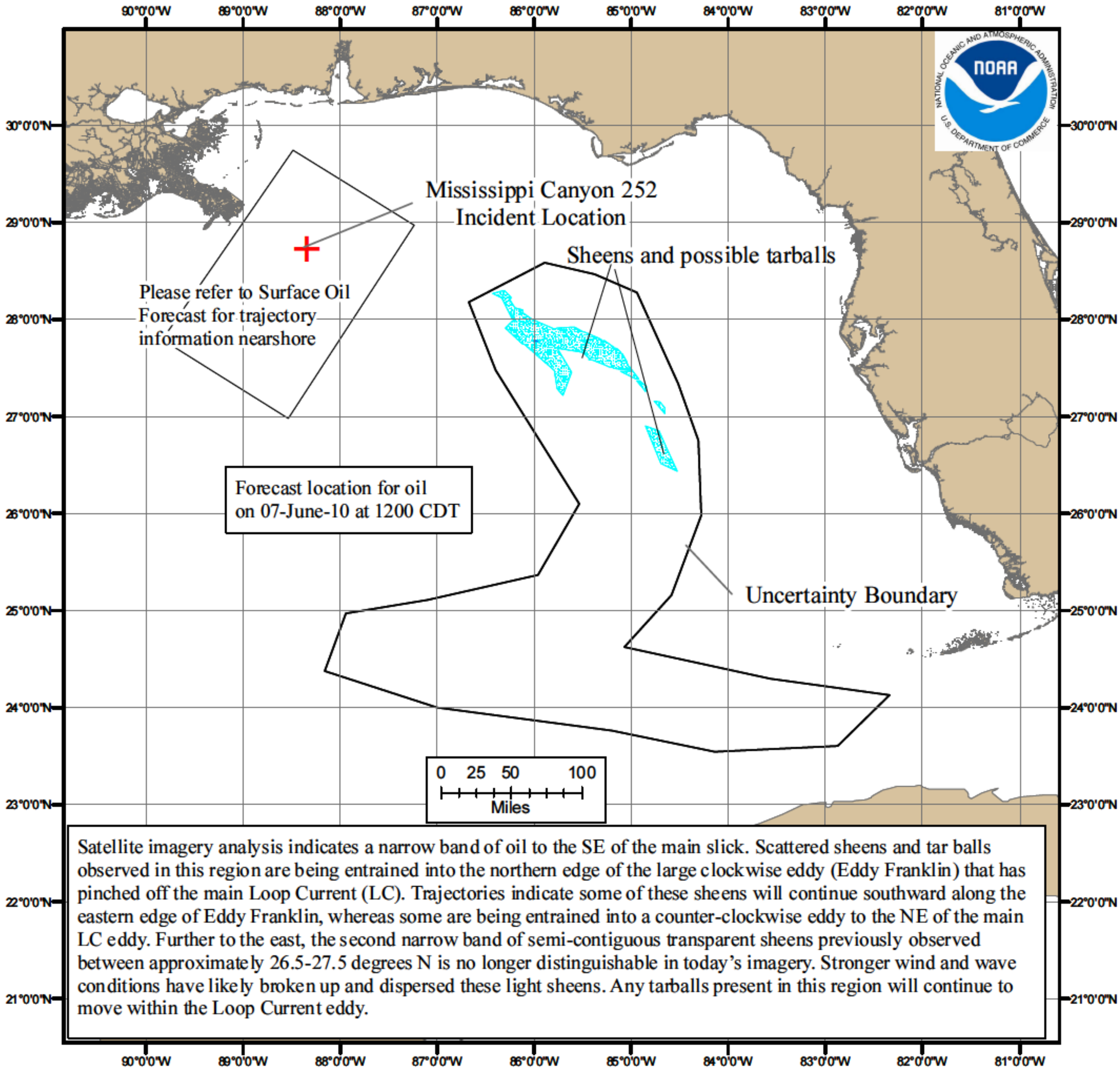
Offshore
Surface Oil Forecast
Deepwater Horizon MC252

NOAA/NOS/OR&R

Offshore

Estimate for: 1200 CDT, Monday, 6/07/10
Date Prepared: 1900 CDT, Friday, 6/04/10

Currents were obtained from four models: NOAA Gulf of Mexico, NavO/NCOM, and NRL/IASNFS and West Florida Shelf/USF. Each includes Loop Current dynamics. Gulf wide winds were obtained from the gridded NCEP product. The model was initialized from Thursday satellite imagery analysis (NOAA/NESDIS). The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization).



Satellite imagery analysis indicates a narrow band of oil to the SE of the main slick. Scattered sheens and tar balls observed in this region are being entrained into the northern edge of the large clockwise eddy (Eddy Franklin) that has pinched off the main Loop Current (LC). Trajectories indicate some of these sheens will continue southward along the eastern edge of Eddy Franklin, whereas some are being entrained into a counter-clockwise eddy to the NE of the main LC eddy. Further to the east, the second narrow band of semi-contiguous transparent sheens previously observed between approximately 26.5-27.5 degrees N is no longer distinguishable in today's imagery. Stronger wind and wave conditions have likely broken up and dispersed these light sheens. Any tarballs present in this region will continue to move within the Loop Current eddy.

this scale bar shows the meaning of the distribution terms at the current time

Next Forecast:
June 5th PM

Document ID: 0.7.19.1820.3

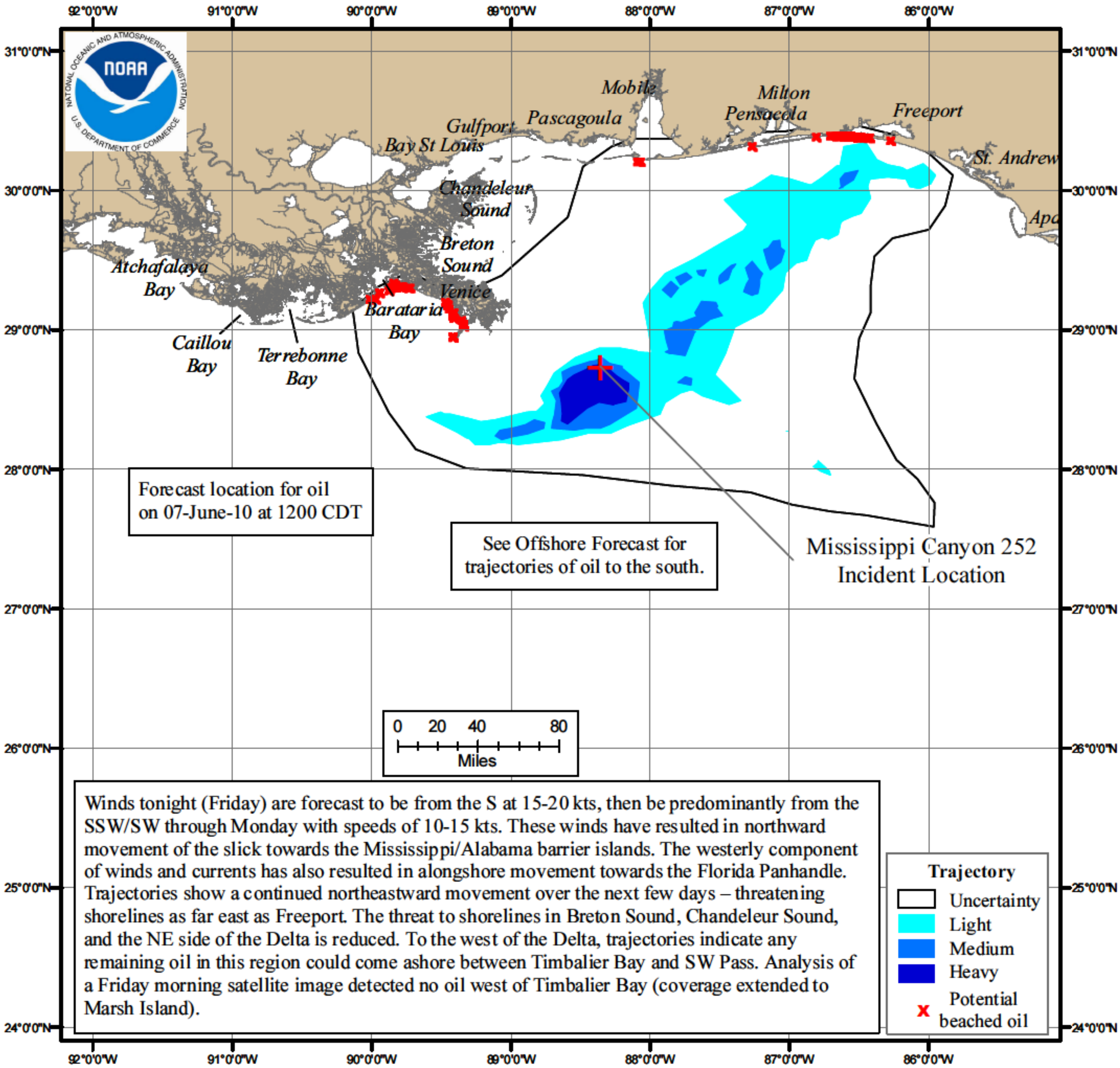
Nearshore Surface Oil Forecast Deepwater Horizon MC252

NOAA/NOS/OR&R

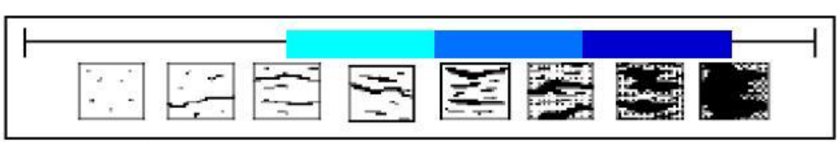
Nearshore

Estimate for: 1200 CDT, Monday, 6/07/10
Date Prepared: 2100 CDT, Friday, 6/04/10

This forecast is based on the NWS spot forecast from Friday, June 4 PM. Currents were obtained from several models (NOAA Gulf of Mexico, West Florida Shelf/USF, NAVO/NRL) and HFR measurements. The model was initialized from Thursday satellite imagery analysis (NOAA/NESDIS) and Friday overflight observations. The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization). Oil near bay inlets could be brought into that bay by local tidal currents.



Winds tonight (Friday) are forecast to be from the S at 15-20 kts, then be predominantly from the SSW/SW through Monday with speeds of 10-15 kts. These winds have resulted in northward movement of the slick towards the Mississippi/Alabama barrier islands. The westerly component of winds and currents has also resulted in alongshore movement towards the Florida Panhandle. Trajectories show a continued northeastward movement over the next few days – threatening shorelines as far east as Freeport. The threat to shorelines in Breton Sound, Chandeleur Sound, and the NE side of the Delta is reduced. To the west of the Delta, trajectories indicate any remaining oil in this region could come ashore between Timbalier Bay and SW Pass. Analysis of a Friday morning satellite image detected no oil west of Timbalier Bay (coverage extended to Marsh Island).



this scale bar shows the meaning of the distribution terms at the current time

Next Forecast:
June 5th PM

Document ID: 0.7.19.1820.4

Shoreline Impact Outlook

Prepared Thursday, June 4, 2010

This map delineates threatened shorelines for the period of June 5 9. Because of the continuous leak at the source, there is potential to impact areas multiple times. Scattered tarballs which are not observable from overflight may impact shorelines ahead of the indicated dates. Forecasting beyond three days has greater uncertainty as to potential impacts.

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0 25 50 100
Miles

NOAA Emergency Response Division (ERD)
Report # 48: June 4, 2010 at 2000 PDT
MC 252 DEEPWATER HORIZON Incident, Gulf of Mexico, Major Spill Incident

Situation Update, Day 46:

Overview: BP's attempt to place the "Top Hat" on the cut riser pipe last night appears to have been successful. BP has reported pumping oil and gas through the new riser pipe to a ship waiting on the surface. It is hoped that a significant portion of the oil leaking from the well-head will be captured by the 'Top-Hat' apparatus. It is unknown how much oil and gas is currently being recovered. BP estimates another 12hrs before an accurate recovery rate is known.

It is important to note that in order for the drill ship at the surface to continually receive oil from the well, it has to hold- or maintain-station above the well-head. There are concerns that severe winds and waves might affect the vessel's ability to hold-station and severe weather plans are being prepared. Also, the drilling of the two relief wells is still continuing, as they are thought to be the more permanent solution to the leaking oil well. The relief wells are estimated to be finished in mid-August.

Trajectories: ORR's modeling team continues to generate daily trajectories for the nearshore and offshore surface oil. Overflights are also conducted on a daily basis (weather permitting) to provide field verification of model trajectories. Onshore winds (S-SW at 15-20kts) have resulted in the northward movement of the slick towards the Mississippi/Alabama barrier islands. The westerly component of the winds and currents has also resulted in alongshore movement of the slick towards the Florida panhandle. Trajectories show a continued northeastward movement of the slick over the next few days, which will continue to threaten shorelines in Alabama and the panhandle of Florida. The threat of oiling continues to decrease for shorelines in Breton Sound, Chandeleur Sound, and the NE side of the Mississippi delta. To the West of the delta, trajectories indicate that any remaining oil in this region could come ashore between Timbalier Bay and SW pass. Analysis of an early morning satellite image detected no oil west of Timbalier Bay.

Offshore: Satellite imagery analysis indicates a narrow band of oil to the SE of the main slick. Scattered sheens and tarballs observed in this region are being entrained into the northern edge of the large clockwise eddy that has pinched off the main Loop Current. Trajectories indicate some of these sheens will continue southward along the eastern edge of the eddy, whereas some are being entrained into a counter-clockwise eddy to the NE of the main Loop Current eddy. Further to the east, the second narrow band of semi-contiguous transparent sheens previously observed is no longer distinguishable in today's imagery. Stronger winds and waves have likely broken up and dispersed these light sheens. Any tarballs present in this region will continue to move within the main Loop Current eddy.

Hot Topics:
Oiled Marshes: With the recent oiling of marshes in Louisiana, there is increasing pressure to start cleaning the marshes. This is a sensitive issue due to the oil still coming ashore and the thought that some of the clean-up methods may be too intrusive.

Sub-surface plume: Oil chemistry data is starting to come in from the various research cruises and we are starting to get a better characterization of the sub-sea plume located near the well-head.

Briefings and meetings:
June 4, 2010:
POTUS visit: Obama visited the Area Command and other sites in the Gulf today. ORR provided visual aid materials for Obama's visit per USCG's request.

June 5, 2010
Lubchenco SCAT trip: Dr. Lubchenco and Secretary Jackson plan to join a SCAT team out of Houma, LA. ORR scientists will accompany the team to answer any questions.

PRFA status update:

Seafood Safety	Approved
Gordon Gunter and Weatherbird II Cruises	Approved verbally, working on obtaining written documentation from FOSC
HF Radar	Being reevaluated by modelers for resubmission for funding, likely directly to BP.
Recreational Fishing	ORR and NMFS are pursuing the rec. fishing assessment as a NRDA study
Remote Sensing Activities by NGS	In review by SSC.
Thomas Jefferson / WHOI cruises for mapping sub surface areas west of the Mississippi Delta for potential hydrocarbons and dispersants	Authorization requested, response positive but funding authorization pending due to spend cap.

Oiled sea turtle recovery operations. Photo: FWC Fish and Wildlife Research Institute.

NOAA Roles: Many personnel are on scene and many more are engaged remotely. Additional NOAA assets are being made available for the spill.

Office of Response and Restoration (OR&R)

- Scientific support to the U.S. Coast Guard and Unified Command

Emergency Response Division (ERD)

- Predict oil fates and effects
- Overflight observations and mapping
- Identify resources at risk
- Recommend appropriate clean-up methods
- Manage data and information

Assessment and Restoration Division (ARD)

- Plan for assessment of injuries to natural resources
- Coordinate with state and federal trustees

National Weather Service

- Incident weather forecasts including marine and aviation

National Environmental Satellite, Data, and Information Service (NESDIS)

- Experimental imagery for spill trajectory forecasts
- Data Visualization

National Marine Fisheries Service (NMFS)

- Issues related to marine mammals, sea turtles, and fishery resources
- Public Affairs support to the Joint Information Center

Office of Marine and Aviation Operations (OMAO)

- USCG Liaison to the DCO Incident Support Team USCG Headquarters
- Aircraft and vessel support

Oceanic and Atmospheric Research

- Oceanographic and atmospheric modeling and data support.
- Gulf of Mexico Sea Grant programs providing technical advice on impacts to living resources and coastal communities.

National Ocean Service

- Support from ONMS for staffing and technical information
- Oceanographic modeling support
- Public Affairs support to Joint Information Center

Received(Date): Sat, 05 Jun 2010 12:11:48 -0400
From: Joe Inslee <Joe.Inslee@noaa.gov>
Subject: Notes from June 5, 11 AM NRT Call
To: NOAAHQ.Leadership@noaa.gov, Policy.Contacts@noaa.gov,PCO.Contacts@noaa.gov, dwh.staff@noaa.gov, David.Kennedy@noaa.gov,KSarri@doc.gov

Morning-
Below are notes from the June 5, 11 AM NRT call

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National Response Team Call
June 5, 2010
11:00 AM

Regarding the next NRT call- they will poll the agencies regarding the value of continuing to hold daily meetings. Then they will decide and apprise.

Bill Conner will inform DWH Staff of any changes.

Situation Status:

- The "Top Hat" has been in place for the last 30 hrs and has recovered 6,000 bbls in a 24 hr period. The flow rate to the surface is still being worked on.

- No hydrates seem to be forming in the "Top Hat".

- The surface support vessels will have a maximum recovery rate of 25,000 bbls a day from the "Top Hat".

- Yesterday approximately 13,000 gallons of dispersant where applied to the surface. Sea sea dispersant use was also approximately 13,000 gallons.

- Both relief wells have halted drilling. One well is testing its BOP the other is having electronic issues with its BOP.

- Yesterday a modification was made to the fisheries closure. Now approximately 32% of the Gulf of Mexico Federal waters are closed to fishing.

Intergovernmental Affairs Update:

- The meeting between the President and the Governors went well yesterday.

- They are looking into where response workers are from due to some expressing concerns that non-local people are being hired.

- The berm permitting process continues to be an issue of financing. Discussion revolves around how money will be given to Louisiana.

- There are growing requests to Federal agencies to participate as witnesses in State Legislature

hearings regarding the spill.

Congressional Affairs

- On the Congressional call yesterday a central issue was how the navigation of websites can be improved for the public.

- There are a growing number of calls to the Hill expressing concerns that although there is allot people wanting to volunteer there is not much utilization of these volunteers.

Legal Affairs

- Continue to work on fiscal law matters regarding BP recovery.

Communication

- Admiral Allen participated in a media event this morning. Another is planned today regarding bird cleaning operations.

- Media continues to look for ways to cover this spill for the long haul.

Joe Inslee
Policy/Outreach Assistant
Assessment and Restoration Division
NOAA Office of Response and Restoration
1305 East West Highway SSMC 4, Rm. 10219
Silver Spring, MD 20910 Office 301 713 4248 ext. 202
Cell 240 460 6472
Fax 301 713 4387

Received(Date): Sun, 06 Jun 2010 16:05:56 -0400
From: Nickie Lambert <Nickie.Lambert@noaa.gov>
Subject: DWH-MC252 Afternoon Update 6Jun10
To: dwh.staff@noaa.gov
Cc: Bill Conner <William.Conner@noaa.gov>, Ken.Barton@noaa.gov
DWH-MC252 Afternoon Update - 6Jun10.docx.doc

Good afternoon DWH Staff,
Attached please find the afternoon update for the Response Operations =
Group. if you have any questions or require further information, please =
contact me.
Vr,
Nickie

Response Operations Afternoon Report.

Response Operations

From BP's website on source operations-

- 10,500 barrels of oil collected and 22 million standard cubic feet of natural gas flared yesterday.
- Efforts to improve portion of oil collectied ongoing for the next 24-72 hours.
- Oil visibly bypassing Top Hat #4 on video feeds.

NRT

- NRT call cancelled today; will resume Monday.

NIC Activities

- NIC IASG lead, Juliette Kayyem, requests agencies be mindful of the burdens VIP visits place on command posts; she suggests VIPs work through their own agency reps in the field to support visits, and not rely on UAC and ICPs. There is a draft set of protocols that is being reviewed by the White House today.
- Dispersant composition - EPA senior management is asking for all Departments and Agencies who have an interest to please inform NIC EPA Rep of status of obtaining the necessary product information either from EPA or the manufacturer of the dispersants for this spill. Suspense - 1200 EDT Monday.
- NOAA NIC representative is consolidating information on the 4 Alternate Technology Programs currently being field tested and on the Federal Register notification of IATAP.

Received(Date): Sun, 06 Jun 2010 18:44:13 -0400
From: John Rapp <John.Rapp@noaa.gov>
Subject: DWH Actions and Updates - June 6, 2010
To: DWH leadership <DWH.Leadership@noaa.gov>
Proposed OMAO Asset DWH Response Schedule 060610.doc
MMST Health and Stranding Update DWHMC252 06-05-10 FINAL.doc
NRDA Activities 6_06_10.doc
OMAO_Assets_Gantt_Chart_060610-1.xlsx
DWH_ACTIONS_and_UPDATES_6.06.2010.xlsx

All,

Below are the daily updates for June 6, 2010 and supporting materials are attached.

John

Issue Teams:

Response Operations

From BP's website on source operations-

- 10,500 barrels of oil collected and 22 million standard cubic feet of natural gas flared yesterday.
- Efforts to improve portion of oil collected ongoing for the next 24-72 hours.
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- NOAA NIC representative is consolidating information on the 4 Alternate Technology Programs currently being field tested and on the Federal Register notification of IATAP.

Science

P-3 update

- Operational discussions with EPA are on-going. Had a coordination call today with EPA, followed by an operational call between EPA/ASPECT and NOAA/ESRL/CSD and AOC to work through logistics.
- ASPECT is is currently conducting flights at 2800', sampling for 24 compounds in real-time, with an additional ~500 post-flight.
- As part of this effort, NOAA and EPA will be conducting calibration flights to ensure comparability of the data. The NOAA/EPA team will also be discussing data storage/archive.
- The P-3 mission will complement the current EPA missions by conducting surveys in the marine boundary layer at 200', 500', and 1000' using a proton transfer reaction mass spectrometer, providing real-time/near-real-time data on a suite of compounds including C8-C11 aromatics, formaldehyde, methanol, acetonitrile, acetone, acetic acid, isoprene, benzene, toluence, methylethylketone, and naphthalene. A "whole air canister" will be used to collect samples on 72 compounds for post-mission analysis (analysis within 24 hours).
- The P-3 is being moved from California and will be ready to fly in the Gulf on likely early-to-mid-week. Exact dates are being worked out.

Walton Smith

- Four scientists from AOML/CIMAS are departing at 6PM today for a transit cruise (Gulfport to Miami) on the R/V Walton Smith.
- CRUISE TRACK- Using information from satellite altimetry and other support, proceed toward front of the Gulf Stream Loop Current at bearing of approximately 135°. Once LC Front identified, proceed along front except as a deviation is desired to sample the Tiger Tail or to cross the front and define properties.

- Conducting chemical, physical, and biological sampling, as well as make observations on the conditions of pelagic birds and mammals (to be performed by Dr. David Lee who has done sensitive observations of this sort for MMS, the USN, NOAA and others is on board as a volunteer to do this work). Sampling highlights include:
  - Collecting samples with a Neuston net at locations in the "Tiger Tail", other sites where observers think there may be oil or tar balls at the surface, and in the region of the Dry Tortugas.
  - Collecting samples for petroleum products and tar balls as feasible using OR&R approved procedures, especially when such material is clearly present.

Living Marine Resources:

Fisheries Closures

- There was no change to the closed area in federal waters for June 06, 2010. The map with the area currently closed is attached.
- Louisiana Department of Wildlife and Fisheries (LDWF) announced the following action in a portion of the Barataria Basin south of Empire, LA in Plaquemines Parish effective at sunset, June 6, due to confirmed reports of oil in the area.
  - The portion of state inside waters north of the inside/outside shrimp line and south of the Mississippi River from the southern shoreline of Red Pass at 89 degrees 28

minutes 13.4 seconds north latitude westward to the western shoreline of the Empire Canal, closes to recreational and commercial fishing.

Seafood Inspection

- Work continued on various seafood documents.

Marine Mammal and Turtle Health and Stranding Report

- Increase of 7 turtle strandings (1 live, heavily oiled in AL, 1 dead in AL, 3 dead in MS, 2 dead in LA)
  - Two of the Kemp's ridleys recovered June 1 from the offshore search/rescue operation died today at Audubon Aquarium
  - 289 total sea turtles verified to date within the "designated spill area" (increase of 7 from June 4)
    - 264 stranded* (increase of 7 from June 4)
    - 242 of the stranded were found dead (increase of 6 from June 4)
    - 22 of the stranded were found alive (increase of 1 from June 4)
    - 25 turtles collected during directed turtle sampling efforts (no change from June 4)
      - 22 live turtles in rehabilitation (decrease of 2 from June 4)
      - 1 turtle collected dead (no change from June 4)
      - 2 turtles died in rehabilitation (increase of 2 from June 4)
  - 128 carcasses to be necropsied, if decomposition stage warrants (increase of 8 from June 4)

- Increase of 2 dolphin strandings (1 live in FL that was euthanized, 1 dead in LA)
  - The live stranded dolphin in Florida was an offshore *Stenella longirostris*, the same species that stranded earlier in the week.
  - 33 dolphins have been verified to date within the "designated spill area" (increase of 2 from June 4).
  - 31 were dead stranded* dolphins (increase of 1 from June 4)
  - 2 were live stranded dolphins, one of which that died shortly after stranding, one that was euthanized upon stranding (increase of 1 from June 4)
  - 7 verified strandings but animals not collected due to stage of decomposition or unable to recover (increase of 1 from June 4)
  - 2 carcasses to be necropsied, if decomposition stage warrants (increase of 1 from June 4)

- Discussions are underway to relocate the turtles currently in rehabilitation at Audubon and IMMS to secondary facilities for longer-term rehab to ensure open space and sufficient staff at the primary de-oiling facilities to handle expected additional turtles in the coming week.

- The current designated spill area encompasses the coastline from the Texas/Louisiana border to Apalachicola (Franklin County), Florida. All stranded animals within this geographic range are being examined following the oil spill response protocols.
- The complete health and stranding report, turtle stranding map, and dolphin stranding map are attached.

NRDA

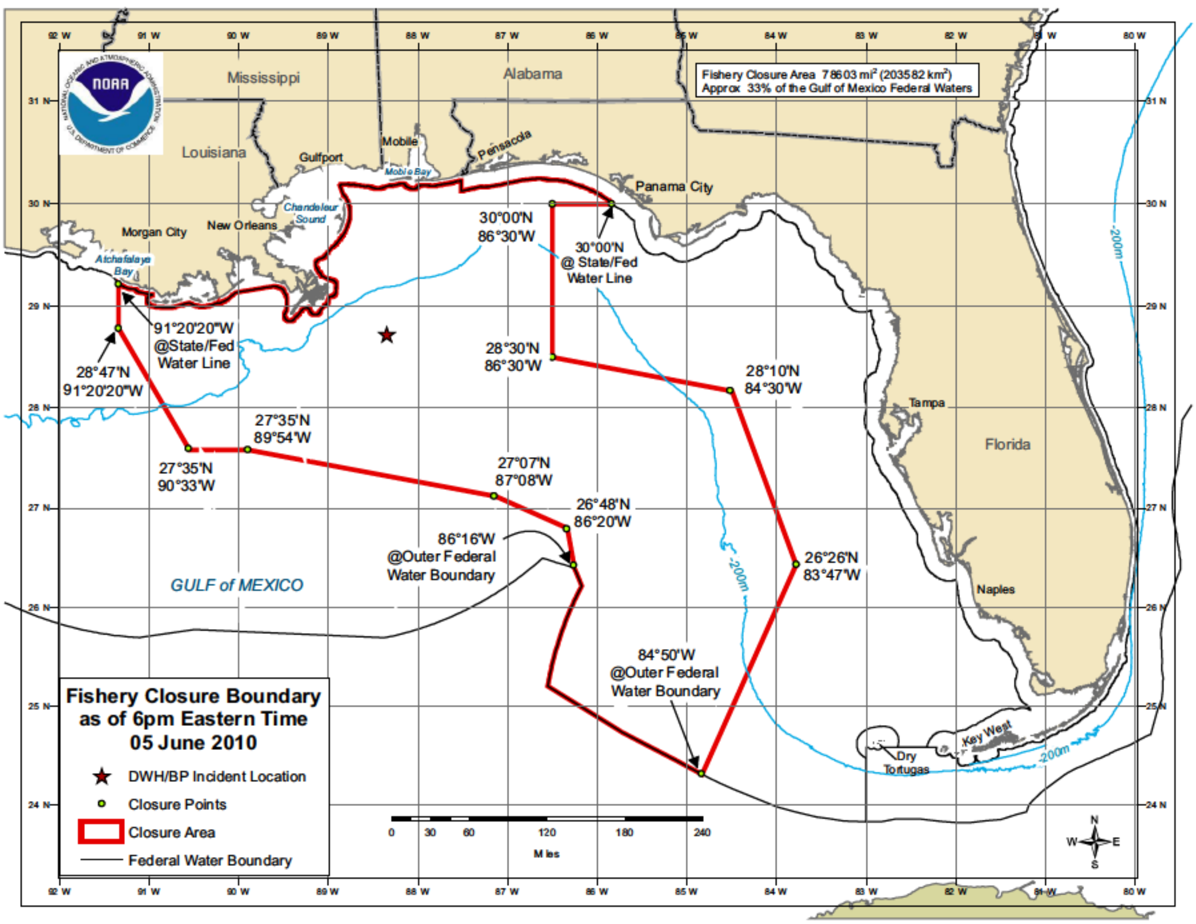
- No significant updates

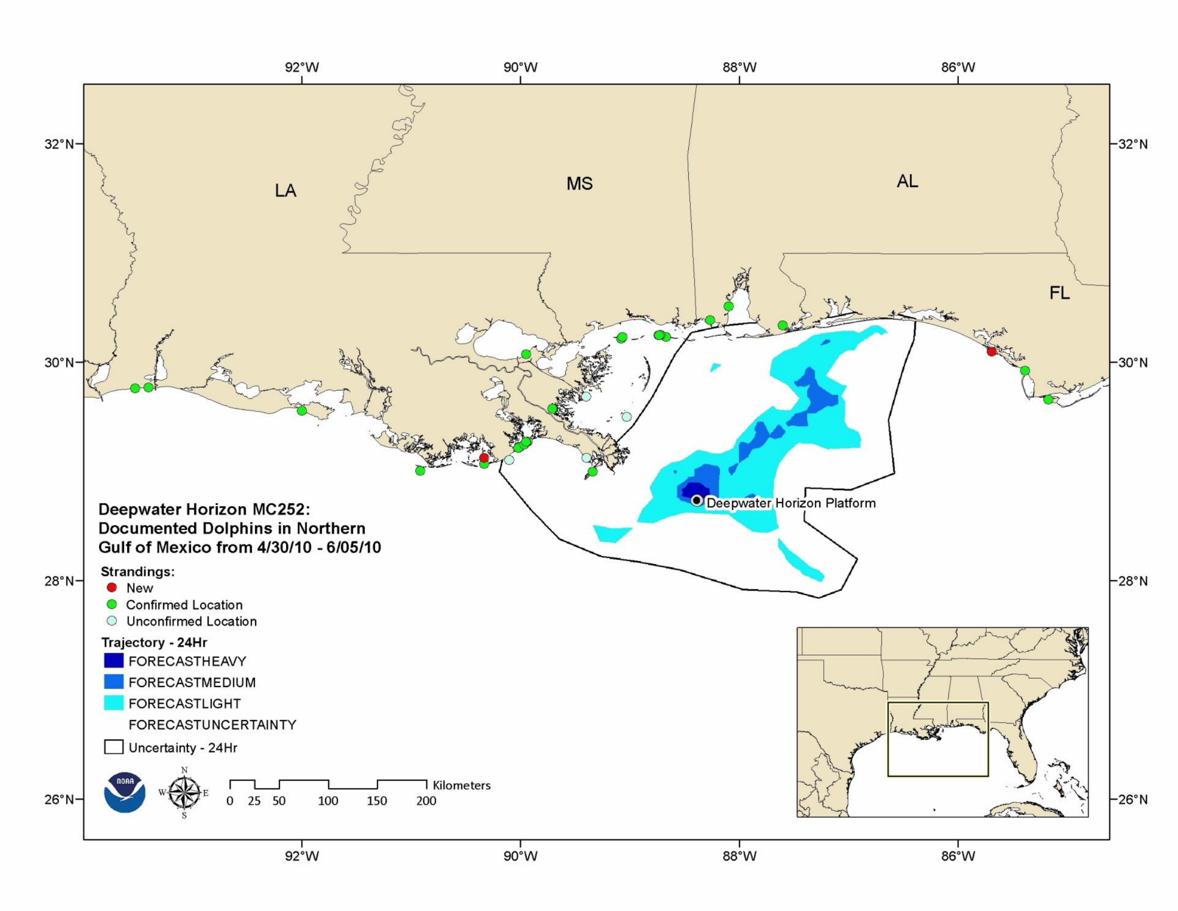
Assets and Platforms

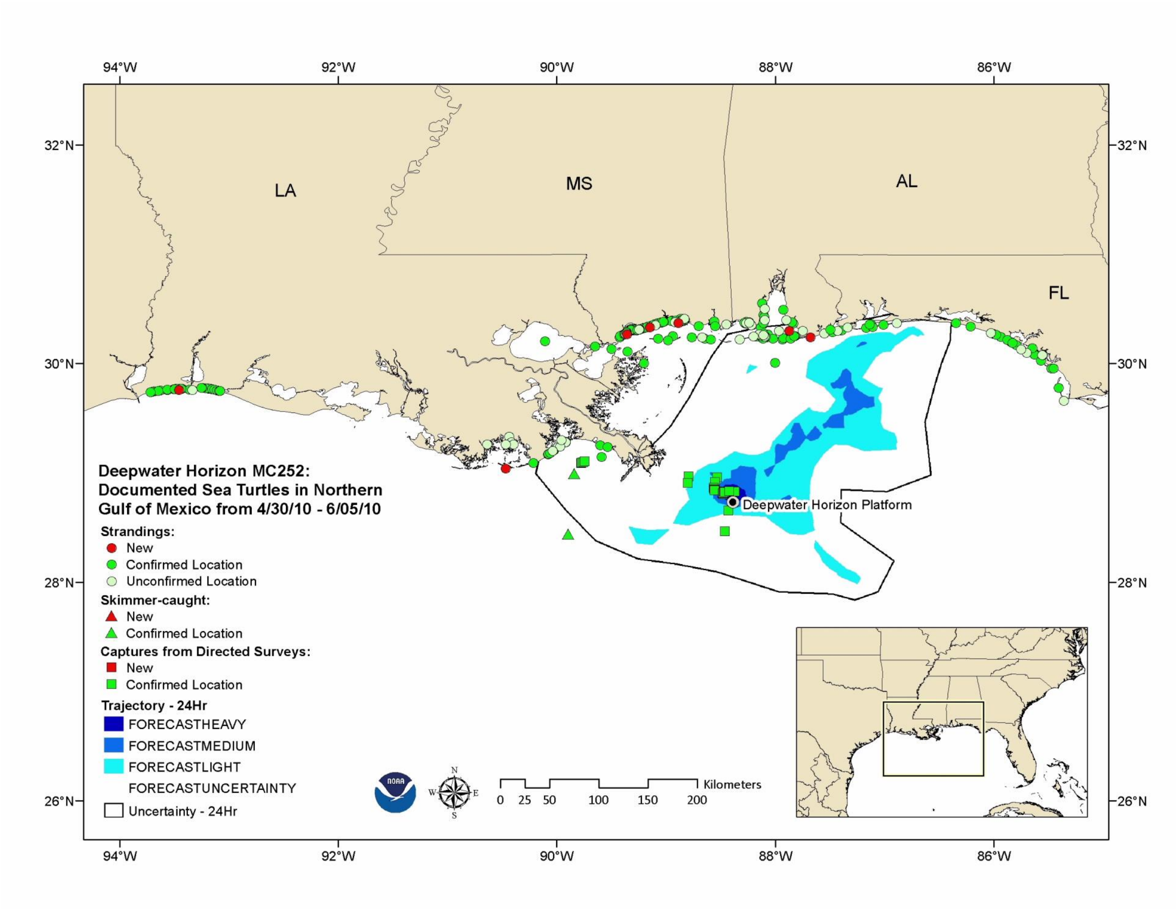
- No significant updates

Functional Teams:

No significant updates




92°W
90°W
88°W
86°W
32°N
30°N
28°N
26°N
LA
MS
AL
FL
Deepwater Horizon Platform
Deepwater Horizon MC252:
Documented Dolphins in Northern
Gulf of Mexico from 4/30/10 - 6/05/10
Strandings:
New
Confirmed Location
Unconfirmed Location
Trajectory - 24Hr
FORECASTHEAVY
FORECASTMEDIUM
FORECASTLIGHT
FORECASTUNCERTAINTY
Uncertainty - 24Hr
Kilometers
0 25 50 100 150 200



94°W
92°W
90°W
88°W
86°W
32°N
30°N
28°N
26°N
LA
MS
AL
FL
Deepwater Horizon Platform
Deepwater Horizon MC252:
Documented Sea Turtles in Northern
Gulf of Mexico from 4/30/10 - 6/05/10
Strandings:
New
Confirmed Location
Unconfirmed Location
Skimmer-caught:
New
Confirmed Location
Captures from Directed Surveys:
New
Confirmed Location
Trajectory - 24Hr
FORECASTHEAVY
FORECASTMEDIUM
FORECASTLIGHT
FORECASTUNCERTAINTY
Uncertainty - 24Hr
Kilometers
0 25 50 100 150 200

Received(Date): Mon, 07 Jun 2010 05:52:20 -0400
From: ICC.Deputy@noaa.gov
Subject: DEEPWATER HORIZON - morning reports
To: Deepwater.HorizonDist@noaa.gov

Deepwater_Horizon_Report_50.pdf
forecast_20100609_1200CDT_20100606_2100CDT_rs.pdf
landfall6_06.pdf
loopcurrent_6_6.pdf
LoopCurrentStatus-6-06.pdf
os_forecast_20100609_1200CDT_20100606_1900CDT_rs.pdf

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NOAA Emergency Response Division (ERD)
Report # 50: June 6, 2010 at 1845 PDT
MC 252 DEEPWATER HORIZON Incident, Gulf of Mexico, Major Spill Incident

Situation Update, Day 48:

Overview: The 'Top Hat' device continues to collect a portion of the oil and gas leaking out of the Mississippi Canyon 252 well-head. BP reports that they recovered over 10,000 bbls of oil through the collection device within the past 24hrs. Efforts are currently underway to increase the collection and processing capacity of the Top-Hat assembly. BP continues to drill the two relief wells that are scheduled to be completed by mid-August.

Trajectories: ORR's modeling team continues to generate daily trajectories for the nearshore and offshore surface oil. Overflights are also conducted on a daily basis (weather permitting) to provide field verification of model trajectories. Onshore winds (S/SW at 10-15kts) are forecast to continue through today. Tonight through Monday winds are expected to reduce to 5-10 kts and stay there through Tuesday. Moderately strong southerly winds have resulted in northward movement of the slick towards the Mississippi/Alabama barrier islands. The westerly component of winds and currents has also resulted in alongshore movement along the Florida Panhandle. Trajectories indicate coastal regions between Dauphin Island, AL and Freeport, FL will continue to experience limited shoreline oiling throughout this forecast period. The threat to shorelines in Breton Sound, Chandeleur Sound, and the NE side of the Mississippi delta is reduced. To the west of the Delta, any remaining floating oil in this region could come ashore between Timbalier Bay and SW Pass.

Offshore: Satellite imagery analysis and overflight observations continue to indicate bands of sheen to the SE of the main slick. Scattered sheens and tar balls observed in these regions are being entrained into the northern edge of the large clockwise eddy that has pinched off the main Loop Current (LC). Trajectories indicate that some of these sheens will continue southward along the eastern edge of this main LC eddy, whereas some are being entrained into the counter-clockwise eddy to the NE of the main LC eddy. Further to the east, a second narrow band of semi-contiguous transparent sheens was not observed today.

Hot Topics:
Endangered Species Act (ESA): ESA concerns are becoming more prevalent regarding sea turtles and shorebirds. Concerns have been brought up regarding in-situ burn operations, skimming operations, shoreline prevention, and shoreline clean-up strategies and their effect on sea turtles, birds and their habitats. There is a lot of focus on ensuring that operations are following proper ESA consultation, when necessary. The concern is that in some cases this has not happened.

PRFA status update:

Seafood Safety	Approved
Gordon Gunter and Weatherbird II Cruises	Approved verbally, working on obtaining written documentation from FOSC

HF Radar	Being reevaluated by modelers for resubmission for funding, likely directly to BP.
Recreational Fishing	ORR and NMFS are pursuing the rec. fishing assessment as a NRDA study
Remote Sensing Activities by NGS	In review by SSC.
Thomas Jefferson / WHOI cruises for mapping sub surface areas west of the Mississippi Delta for potential hydrocarbons and dispersants	Authorization requested, response positive but funding authorization pending due to spend cap.

NOAA Roles: Many personnel are on scene and many more are engaged remotely. Additional NOAA assets are being made available for the spill.

Office of Response and Restoration (OR&R)

- Scientific support to the U.S. Coast Guard and Unified Command

Emergency Response Division (ERD)

- Predict oil fates and effects
- Overflight observations and mapping
- Identify resources at risk
- Recommend appropriate clean-up methods
- Manage data and information

Assessment and Restoration Division (ARD)

- Plan for assessment of injuries to natural resources
- Coordinate with state and federal trustees

National Weather Service

- Incident weather forecasts including marine and aviation

National Environmental Satellite, Data, and Information Service (NESDIS)

- Experimental imagery for spill trajectory forecasts
- Data Visualization

National Marine Fisheries Service (NMFS)

- Issues related to marine mammals, sea turtles, and fishery resources
- Public Affairs support to the Joint Information Center

Office of Marine and Aviation Operations (OMAO)

- USCG Liaison to the DCO Incident Support Team USCG Headquarters
- Aircraft and vessel support

Oceanic and Atmospheric Research

- Oceanographic and atmospheric modeling and data support.
- Gulf of Mexico Sea Grant programs providing technical advice on impacts to living resources and coastal communities.

National Ocean Service

- Support from ONMS for staffing and technical information
- Oceanographic modeling support
- Public Affairs support to Joint Information Center

Nearshore Surface Oil Forecast Deepwater Horizon MC252

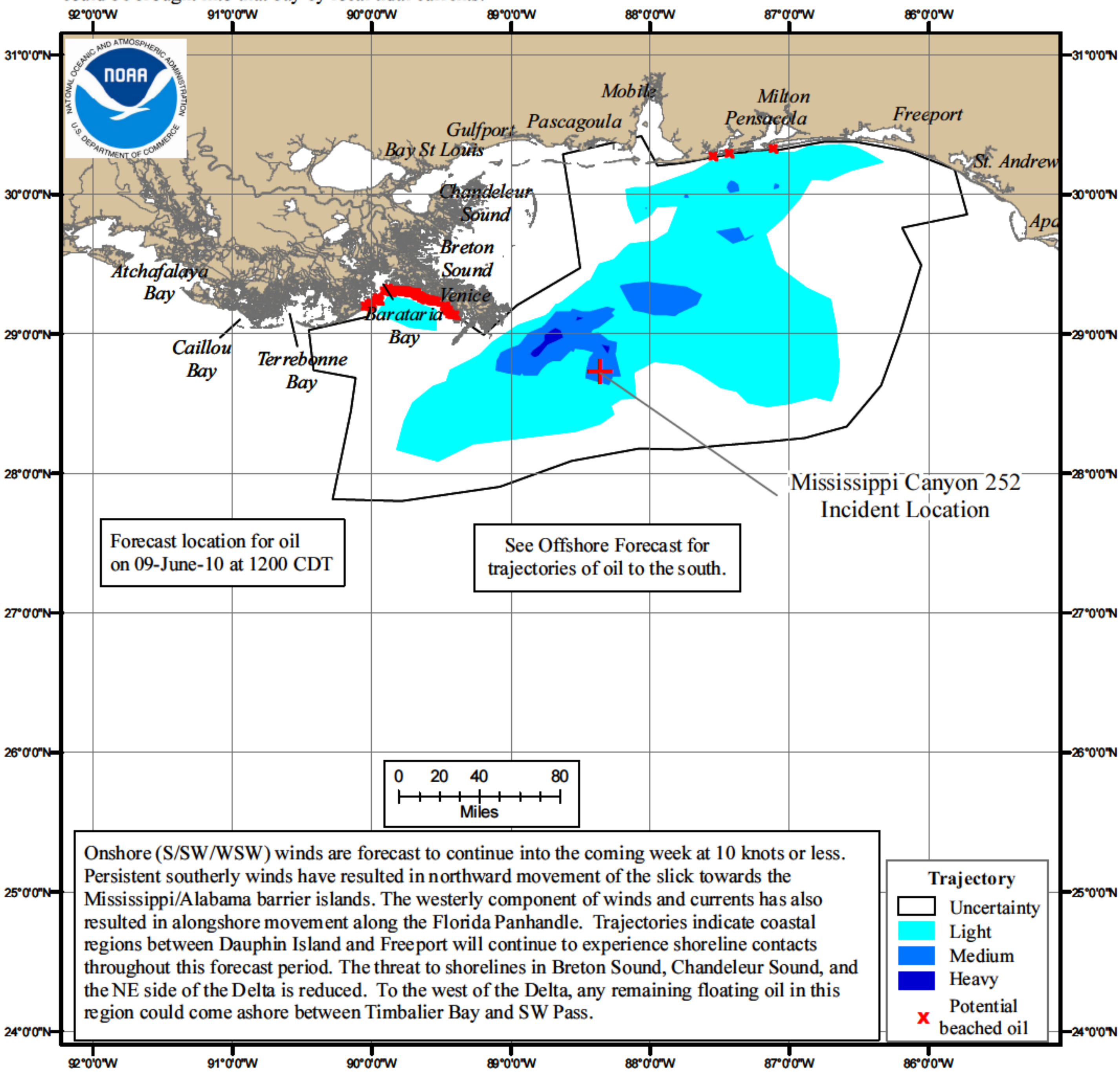
NOAA/NOS/OR&R

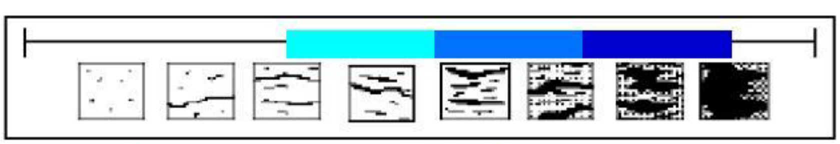
Nearshore

Estimate for: 1200 CDT, Wednesday, 6/09/10

Date Prepared: 2100 CDT, Sunday, 6/06/10

This forecast is based on the NWS spot forecast from Saturday, June 5 PM. Currents were obtained from several models (NOAA Gulf of Mexico, West Florida Shelf/USF, NAVO/NRL, NC St/SABGOM). The model was initialized from Sunday morning satellite imagery analysis (NOAA/NESDIS) and Sunday overflight observations. The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization). Oil near bay inlets could be brought into that bay by local tidal currents.

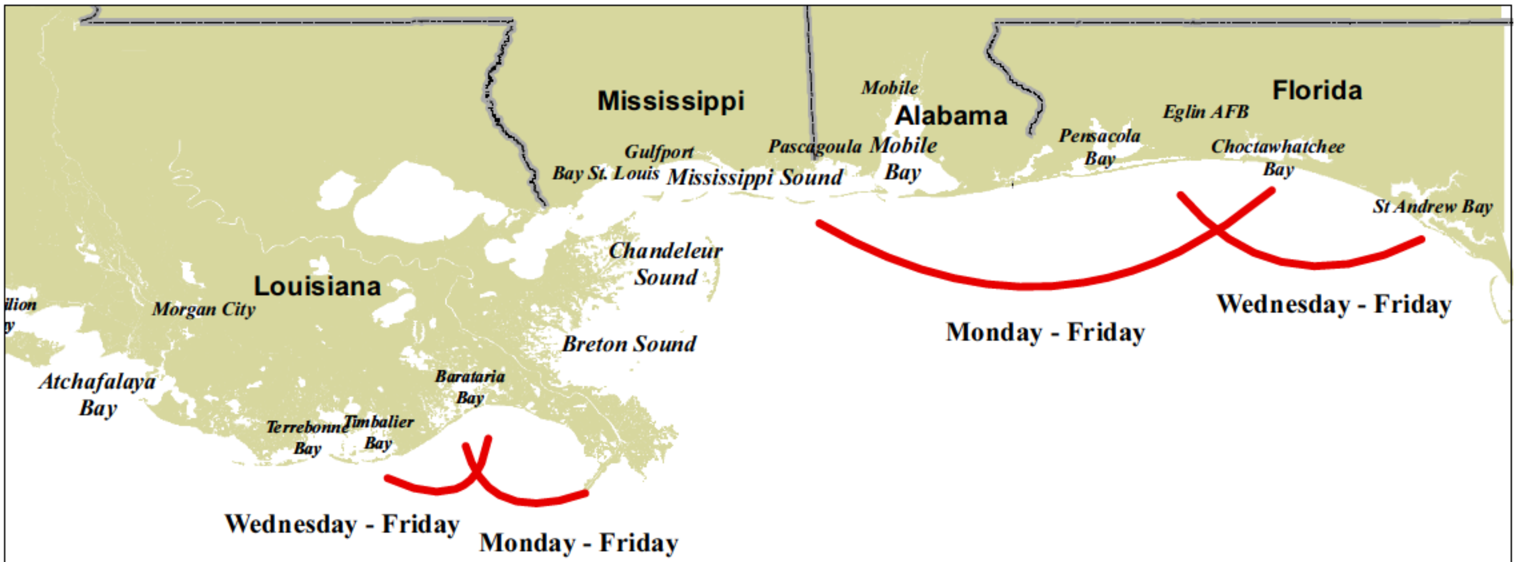




this scale bar shows the meaning of the distribution terms at the current time

Next Forecast:
June 7th PM

Document ID: 0.7.19.1853.2



Shoreline Impact Outlook

Prepared Sunday, June 6, 2010

This map delineates threatened shorelines for the period of June 7 11 Because of the continuous leak at the source, there is potential to impact areas multiple times. Scattered tarballs which are not observable from overflight may impact shorelines ahead of the indicated dates. Forecasting beyond three days has greater uncertainty as to potential impacts.

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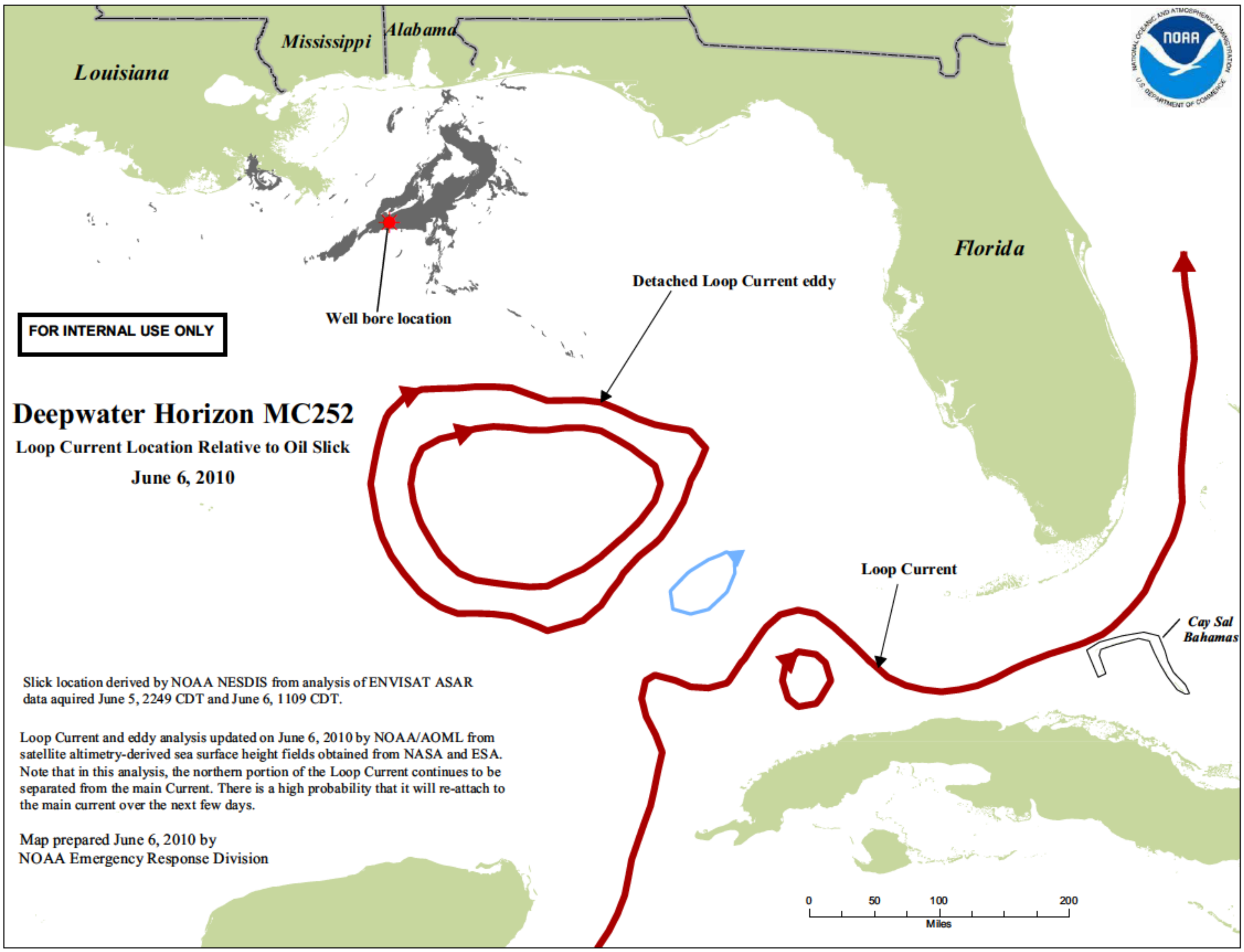
0 25 50 100
Miles



Deepwater Horizon MC252

Loop Current Location Relative to Oil Slick

June 6, 2010

Slick location derived by NOAA NESDIS from analysis of ENVISAT ASAR data aquired June 5, 2249 CDT and June 6, 1109 CDT.

Loop Current and eddy analysis updated on June 6, 2010 by NOAA/AOML from satellite altimetry-derived sea surface height fields obtained from NASA and ESA. Note that in this analysis, the northern portion of the Loop Current continues to be separated from the main Current. There is a high probability that it will re-attach to the main current over the next few days.

Map prepared June 6, 2010 by
NOAA Emergency Response Division

TIME: 8:00pm CDT, June 6, 2010
TO: NOAA SSCs
FROM: NOAA Office of Response and Restoration / Emergency Response Division
Seattle, WA 98115

SUBJECT: Deepwater Horizon MC252 incident and the Loop Current

Summary The pattern continues to show minimal risk of the Loop Current serving as a significant mechanism to transport oil toward any shorelines. There continues to be no significant amounts of oil being moved toward the Loop Current. However, there continues to be persistent sheens in the northern parts of the warm core ring that is detached (or nearly so) from the Loop Current. The anomaly that has been observed by satellite analysis on the outside of the eddy on the eastern side was not visible in satellite analysis today. A overflight (Wesley) today did not report significant amounts of oil to the south and southeast of the source.. There has been no evidence of high concentrations of oil in or near the Loop Current.

The northern eddy is still showing signs of re-attaching to the main Loop Current, and may re-join it over the next few days to a week. Depending on which model you use, there either is or isn't a connection to the main Loop Current on the southwestern side of the warm core eddy. Buoys dropped in the Loop Current earlier this week and last week are consistent with the models showing the northern eddy as separated. In addition, some of the models indicate a pathway from the far eastern edge of the main eddy to the Florida Current, and passing through the Florida Straits. Two additional buoys were dropped a few days ago. We continue to monitor the situation closely.

The sheens observed in the overflight a few days ago are not likely to reach the Florida Straits in the next 3-4 days. Any oil ultimately making it to the Florida Straits will likely consist of widely scattered tarballs. At this time, we estimate that the fraction that may reach shorelines may be slightly above background levels of tarballs already on the Florida shorelines.

How we are monitoring We continue to monitor the Loop Current characteristics from a number of satellite and model sources, a vessel contracted by BP to monitor at the northern front, and buoys dropped in or near the Loop Current over the last two weeks.

The sheen that has been pulled toward the Loop Current continues to be stretched out and thinned. A NOAA today observed a patch of transparent sheen and wind rows to the northeast of the main northern eddy.

Light sheen on the leading edges of slicks may be accompanied by tarballs that are generally not visible from fixed wing aircraft or satellite observations. Shipboard monitoring coordinated with aerial positioning is the best method to determine if there are tarballs associated with this surface sheen. Much work has been done to secure a ship for this mission, which will hopefully be confirmed in the next couple days.

What can be expected in the future It is likely that at some point in the future, another fraction of the oil will move south from the spill site. If this oil gets entrained into the northern eddy while it is still separated, the oil will tend to remain in the eddy, circulating around the middle of the Gulf, far from shore, as it continues to weather and dissipate. However, when this large eddy reconnects with the main Loop, any oil moved to the northern extent of the Current will once again have a pathway to the Florida Straits and beyond. We will continue daily monitoring of the Loop Current in order to monitor this re-connection.

Offshore Surface Oil Forecast Deepwater Horizon MC252

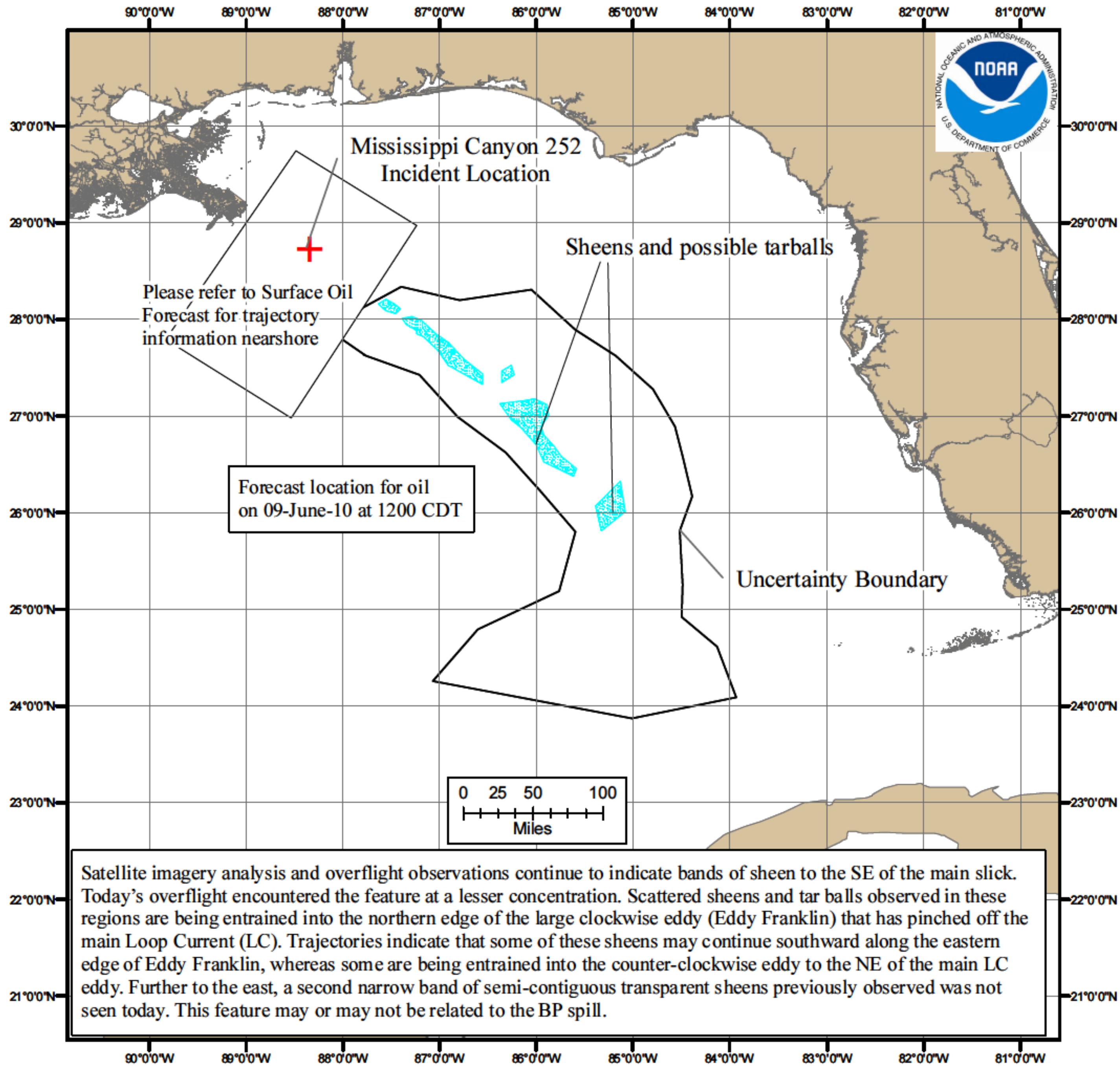
NOAA/NOS/OR&R

Offshore

Estimate for: 1200 CDT, Wednesday, 6/09/10

Date Prepared: 1900 CDT, Sunday, 6/06/10

Currents were obtained from five models: NOAA Gulf of Mexico, NavO/NCOM, NRL/IASNFS, West Florida Shelf/USF, and NC St./SABGOM. Each includes Loop Current dynamics. Gulf wide winds were obtained from the gridded NCEP product. The model was initialized from June 6th AM satellite imagery analysis (NOAA/NESDIS) and NOAA overflight observations from today. The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization).



Satellite imagery analysis and overflight observations continue to indicate bands of sheen to the SE of the main slick. Today's overflight encountered the feature at a lesser concentration. Scattered sheens and tar balls observed in these regions are being entrained into the northern edge of the large clockwise eddy (Eddy Franklin) that has pinched off the main Loop Current (LC). Trajectories indicate that some of these sheens may continue southward along the eastern edge of Eddy Franklin, whereas some are being entrained into the counter-clockwise eddy to the NE of the main LC eddy. Further to the east, a second narrow band of semi-contiguous transparent sheens previously observed was not seen today. This feature may or may not be related to the BP spill.

this scale bar shows the meaning of the distribution terms at the current time

Next Forecast:
June 7th PM

Document ID: 0.7.19.1853.6

Received(Date): Mon, 07 Jun 2010 13:59:52 -0400
From: Andrew Winer <Andrew.Winer@noaa.gov>
Subject: Air quality Monitoring systems
To: "dwh.staff@noaa.gov" <dwh.staff@noaa.gov>

This is indicative of the type of question I am receiving from fishermen involved in cleanup operations. Do we have an answer for what air quality testing is occurring that would be applicable to fishermen working in the Gulf?

Thanks,

Andy Winer

Director of External Affairs

NOAA Communications & External Affairs

(202) 482-4640

andrew.winer@noaa.gov

From: Kim Chauvin [mailto:kimchauvin@mariahjadeshrimp.com]
Sent: Monday, June 07, 2010 9:48 AM
To: 'Andrew Winer'
Subject: RE: Air quality Monitoring systems

Andy,

Would there be any difference in the air quality down on the water to the 2800 feet that these tests are being done? My worry is that the guys on the water are right on top of this stuff as far as the oil. As for the dispersant spraying, this stuff moves through the air wherever they're spraying, at what height is this being sprayed down? Are they spraying at 2800 feet or lower/higher?

I still feel the fitted respirators and air quality monitors on the vessels should be on the vessels to protect our men and women out on the water. Can you recommend which ones to purchase and install. I'm looking at putting them on my vessels and gathering the data?

I’ve read up on the Exxon Valdez and this is exactly how the Alaska crew lost their battle when all of those men/women had gotten sick by not being prepared. Of course, my prayers are that no one gets sick, but since we’ve already had people sick we need as a community to prepare ourselves.

Thanks for your time.

Kimberly Chauvin

Mariah Jade Shrimp Company

5248 Bayouside Drive

Chauvin, LA 70344

985-594-6304 Business

www.mariahjadeshrimp.com

kimchauvin@mariahjadeshrimpcom

Received(Date): Mon, 07 Jun 2010 15:04:49 -0400
From: Jason Rolfe <Jason.Rolfe@noaa.gov>
Subject: NIC Report Out - 7 June
To: "Mark.W.Miller" <Mark.W.Miller@noaa.gov>,Bill Conner <William.Conner@noaa.gov>,_HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>,Timothy Gallagher <timothy.gallagher@noaa.gov>,Richard R Wingrove <Richard.R.Wingrove@noaa.gov>,Nathalie Valette-Silver <Nathalie.Valette-Silver@noaa.gov>,Ralph Lopez <Ralph.Lopez@noaa.gov>,Michelle A Johnston <Michelle.A.Johnston@noaa.gov>,John Wagner <John.Wagner@noaa.gov>

ADM Allen has approved the Joint Analysis Group (JAG) as a new scientific group under the NIC IASG. Their task is to provide comprehensive characterization of the surface and sub-surface oceanography, oil and dispersant data derived from the coordinated sampling efforts of vessels contracted or owned by BP, NOAA and academic scientists. This group needs to coordinate with the NIC-IASG Subsurface Dispersed Oil Group (SDOG) that was tasked about two weeks ago with a similar mission. The NIC-IASG/SDOG has requested the formal integration of the 2 groups to insure efficient communication/collaboration.

ERMA map products continue to gain high visibility – ERMA team here continues to provide ERMA displays for the NIC situation unit briefings as well as provide demonstrations for visiting VIPs. They are also producing map products for DHS, USCG leaders and the White House. All products and services from the ERMA team here met with great praise and interest for continued support at NIC Situation Unit.

NRT call to shift to a Mon, Wed, Friday at 1100 EDT schedule, effective 9 June. No NRT call on 8 June. NIC IASG to participate more in the NRT calls. There is an attempt to revert the NRT call back to more of a working call. The IASG will provide relevant topics for the NRT agenda (due to CAPT Lloyd 1400 prior day). The NIC IASG will provide 5 minutes of IASG issues summary and 5 minutes providing a feature issue update.

Received(Date): Mon, 07 Jun 2010 15:15:22 -0400
From: "Dave.Westerholm" <Dave.Westerholm@noaa.gov>
Subject: Corexit 9500 and 9527
To: _HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>
Cc: David Kennedy <David.Kennedy@noaa.gov>, Jen Pizza <Jen.Pizza@noaa.gov>

In the press and at least one Hearing the topic of Corexit being banned in Europe (and specifically the UK) has been brought up.
Alan Mearns requested and received a more definitive answer which boils down to all oil spill treatment products must pass both the "Sea" (using the Brown Shrimp) and "Rocky Shore" (using the Common Limpet) toxicity tests - Corexit failed the Rocky Shore test. However, existing stocks were still allowed to be considered for use under certain conditions because the UK had extensive stockpiles and Corexit is efficacious against heavier oils.
Because of the number of times dispersants have come up, I have asked the DWH staff to forward this to leadership. You will note reference to a letter to EPA and there were also other attachments to the original e-mail. If anyone is interested in this level of detail, let me know and I can forward that information.
v/r
Dave

Subject:
RE: Dispersant Statement to EPA
From:
"Dispersants (MMO)" <Dispersants@marinemanagement.org.uk>
Date:
Mon, 07 Jun 2010 10:08:32 +0100
To:
"alan.mearns" <Alan.Mearns@noaa.gov>
CC:
"Waldock, Mike J (CEFAS)" <mike.waldock@cefas.co.uk>, "Camplin, Bill WC (CEFAS)" <bill.camplin@cefas.co.uk>, Dawn Lawrence <lawrenceex@earthlink.net>, Gary Shigenaka <Gary.Shigenaka@noaa.gov>, William Conner <William.Conner@noaa.gov>, Nichols.Nick@epamail.epa.gov

Alan,

Thanks for getting in touch, apologies I couldn't get back to you before the weekend. I have answered your question in the text below, and have also attached a recent summary of our communications with the US EPA.

In 1996 a review of the UK Testing, Approval and Use of Oil Dispersants (also attached) recommended that all oil spill treatment products must pass both the "Sea" (using the Brown Shrimp) and "Rocky Shore" (using the Common Limpet) toxicity tests previously products could be approved after passing only one of the tests.

The rationale behind this is outlined in the sections 31 & 32 of the 1996 review and was due to concerns that offshore application of products could be washed or blown ashore.

When Corexit 9500 and 9527 came to renew their approval in 1998, they

failed the "Rocky Shore" test (along with another dispersant Chemkleen ODA JAS), and approved was therefore withdrawn. Existing stocks were, however, still allowed to be considered for use under certain conditions, the rationale being that Corexit 9500 and 9527, of which the UK had extensive stockpiles, is efficacious against heavier oils and it would be useful for the UK to maintain its capacity to deal with these kind of oils.

Corexit 9500 and 9527 are therefore not "banned" in the UK, something we have reiterated to the press. Corexit 9500 and 9527 have not been shown to display excessive toxicity in the offshore marine environment.

Furthermore we are currently developing a new testing protocol to allow the use, in the offshore environment only, of products which are highly efficacious against heavier oils. These products would not be required to pass the "Rocky Shore" test, but would be required to prove their efficacy against heavier oils, and pass the "Sea" test.

I hope this helps and do not hesitate to contact me if more details are required.

Best regards,

Nick Greenwood
Marine Pollution Response Manager
Marine Management Organisation
Lancaster House
PO Box 1275
Newcastle Upon Tyne
NE99 5BN
Tel: 0191 376 2666
Web: www.marinemanagement.org.uk

Received(Date): Mon, 07 Jun 2010 15:50:04 -0400
From: Justin Kenney <Justin.kenney@noaa.gov>
Subject: DRAFT Weatherbird press release
To: "Deepwater Staff (dwh.staff@noaa.gov)" <dwh.staff@noaa.gov>,"DEEPWATER Leadership (dwh.leadership@noaa.gov)" <DWH.Leadership@noaa.gov>,"Gilson, Shannon" <SGilson@doc.gov>, "Sarri, Kristen" <KSarri@doc.gov>
image001.png

Hello folks, below is a DRAFT press release for tomorrow's announcement of the Weatherbird data. Drs. Lubchenco and Murawski weighed in already, and I would like to give everyone a chance to see the direction we are headed. Comments please, and soon.

Many thanks,

Justin Kenney

NOAA Director of Communications & External Affairs

Office: 202-482-6090

Cell: 202-821-6310

Email: justin.kenney@noaa.gov

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NOAA Completes Initial Analysis of *Weatherbird II* Water Samples

Research part of larger effort to solve 3-dimensional puzzle of where the BP oil is sub-surface

NOAA's independent analysis of some water samples provided from the May 22-28 research mission of the University of South Florida's R/V *Weatherbird II* confirmed the presence of very low concentrations of sub-surface oil and PAHs (polycyclic aromatic hydrocarbons, which include carcinogens such as benzoapyrene) at sampling depths ranging from 50 meters to 1000 meters. The *Weatherbird* samples came from three stations: 40 and 45 nautical miles to the

northeast of the well head and 142 nautical miles southeast of the well head (see chart). NOAA's analysis of the presence of subsurface oil determined that the concentration of oil is in the range of less than 0.5 parts per million, and PAH levels in range of parts per trillion. NOAA announced its analysis in conjunction with the University of South Florida from its campus in St. Petersburg, Florida.

"We have always known there is oil under the surface; the questions we are exploring are where is it, in what concentrations, where is it going, and what are the consequences for the health of the marine environment?" said NOAA Administrator Dr. Jane Lubchenco. "This research from the University of South Florida contributes to the larger, three-dimensional puzzle we are trying to solve, in partnership with academic and NOAA scientists."

Other NOAA research missions that are fitting complimentary pieces of the 3-D puzzle include the NOAA Ship *Thomas Jefferson*, a 208-foot survey vessel, which is currently underway on a mission in the vicinity of the BP Deepwater Horizon oil spill. Researchers are taking water samples and testing advanced methods for detecting submerged oil while gathering oceanographic data in the area's coastal waters. The NOAA Ship *Gordon Gunter*, a 224-foot research vessel, returned June 3 from an eight-day oil detection mission in the vicinity of the BP Deepwater Horizon well head. During the effort, researchers collected water samples, conducted plankton tows, and employed echo sounders, autonomous underwater vehicles and other technologies to collect subsurface data. In addition, NOAA's P-3 "Hurricane Hunter" is deploying instruments to better track the movement of the Loop Current, and therefore improve our understanding of where the oil is moving at the surface and below the surface.

Along with its analysis for the presence of oil and PAHs, NOAA's analysis to "fingerprint" the *Weatherbird* oil samples to the BP/Mississippi Canyon 252 (MC-252) source concluded that:

· Oil found in surface samples taken at the "Slick 1" source were consistent with the MC252 source,

· Oil found in samples taken from Station 01, 142 nautical miles southeast of the well head, at 100 meters and 300 meters were not consistent with the MC252 source.

· Trace oil found in samples from Station 07 at the surface, at 50 meters and at 400 meters are in concentrations too low to confirm the source, and

· [Still awaiting results for the final bullet]

In general, NOAA's analysis of the *Weatherbird* samples shows that concentrations of hydrocarbons decrease with depth, with a notable exception of samples at 300 meters from Station 07, which warrants additional research attention. [Bob and Steve, I need a "so what"

sentence here about this finding. Also, PAH levels are very low in all samples, with only five of 25 having reportable concentrations of the priority pollutant PAHs.

STAY CONNECTED

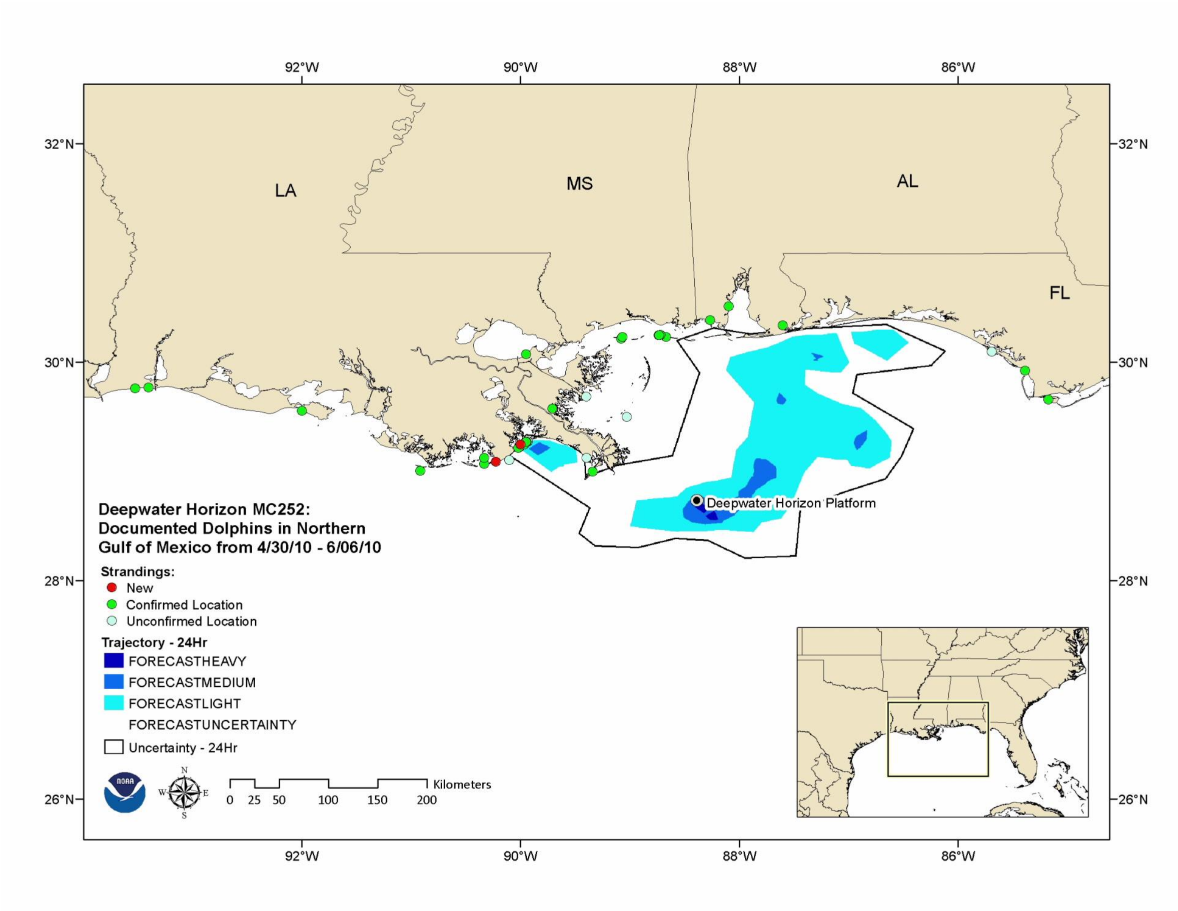
Document ID: 0.7.19.1722.1

NOAA Science
Situational Awareness Briefing

Deepwater Horizon MC252

June 8, 2010

EXPERIMENTAL PRODUCT
** For Internal Use ONLY **



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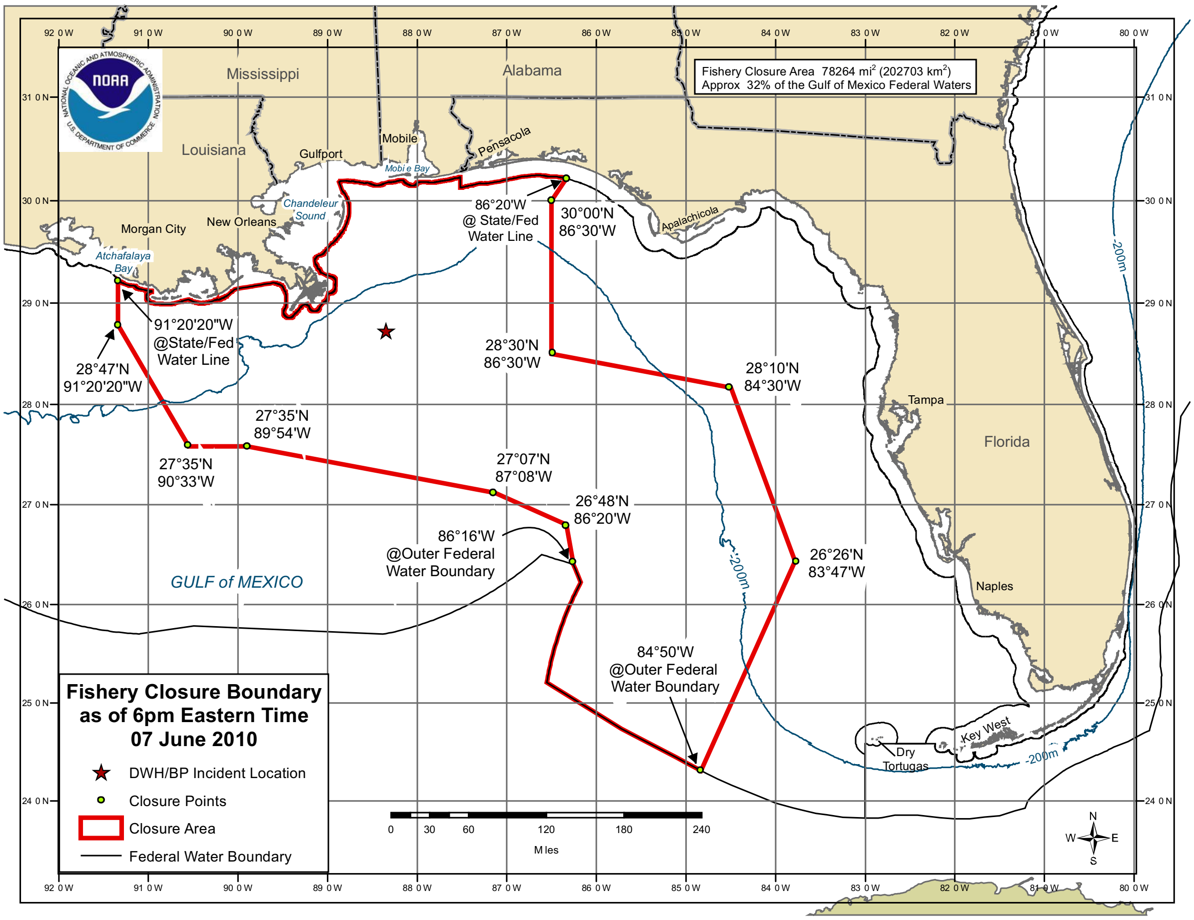
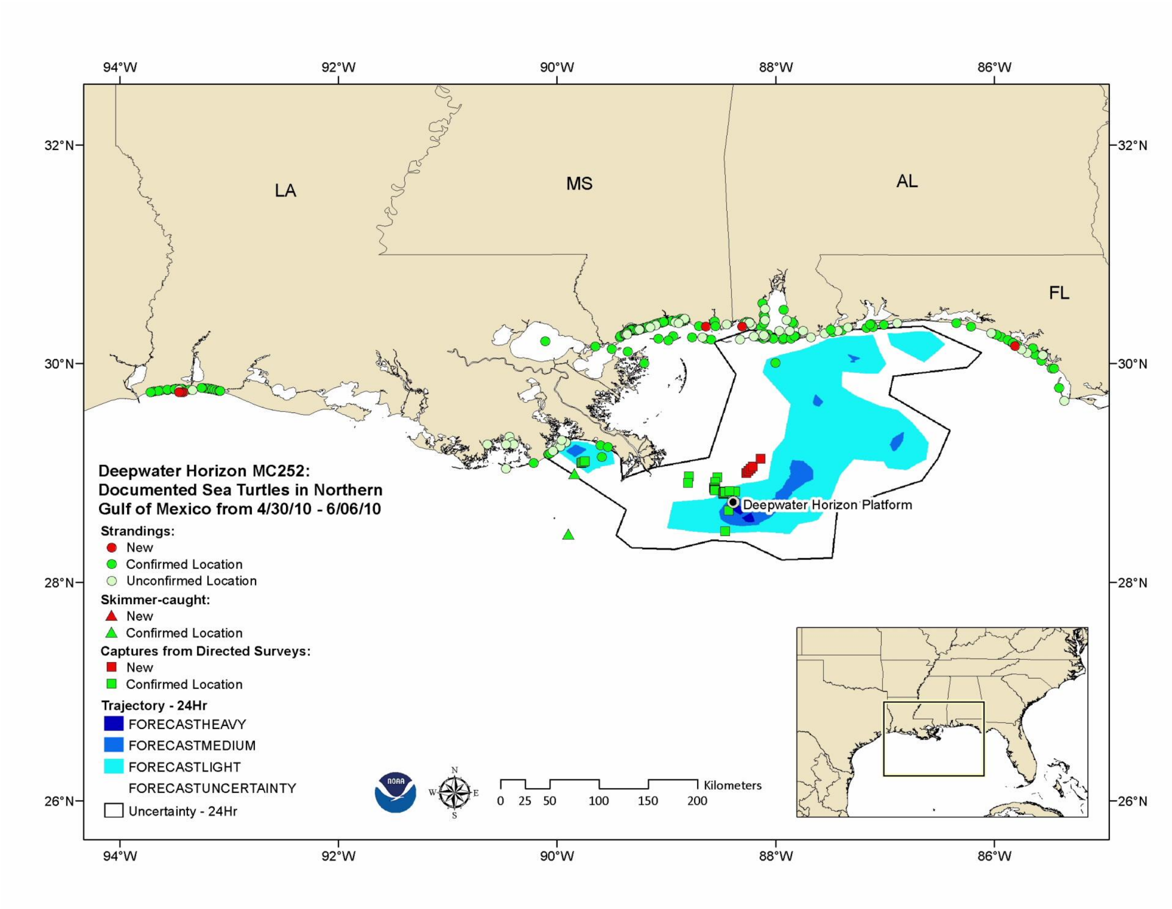


Document ID: 0.7.19.2151



Document ID: 0.7.19.2151

Response Operations
• Top Hat #4 in place, 3 of 4 valves open; offloading oil from ENTERPRISE to the MASSACHUSETTS scheduled for this evening. See also NRT, below.
NRT
• 11,190 bbls of oil collected on Enterprise; subsea dispersant ~ 10 gal/min. Vessel Q4000 prepping for potential choke/kill line operations.
• Plans emerging for Community Relations Teams for better outreach.
NIC Activities
• Joint Analysis Group (JAG): ADM Allen has approved the Joint Analysis Group (JAG) as a new scientific group under the NIC IASG. Their task is to provide comprehensive characterization of the surface and sub-surface oceanography, oil and dispersant data derived from the coordinated sampling efforts of vessels contracted or owned by BP, NOAA and academic scientists. The group will need to coordinate with the NIC-IASG Subsurface Dispersed Oil Group (SDOG) which was tasked about two weeks ago with a similar mission. The NIC-IASG/SDOG has requested formal integration of the 2 groups to insure efficient communication/collaboration.
• **ERMA:** ERMA team is providing ERMA displays for the NIC situation unit briefings, demonstrations for VIPs, and map products for DHS, USCG and the White House. ERMA team products and services have earned high praise, and the NIC Situation Unit has interest in continued support.
• **R/V Seward Johnson:** Petrobras has offered to delay delivery of the R/V Seward Johnson to Brazil so that the ship is available to work on the DWH spill. A letter has been sent to Petrobras confirming a delay of approx. 120 days. Shirley Pomponi and Pete Tatro at Harbor Branch are the points of contact.

Science Box Talking Points
(1) "Science Box" is considering four follow-up large ship missions which are dependent on the availability of the fleet:
o Loop current dynamics (ship & plane)
o Seafood safety - broad scale surveys of baselines, edges of closed areas and under currently oiled areas using 2 ships, one for bottom fish one using pelagic longlines in deep water
o Shallow (5 to 50 fathoms) and deep=water oil trajectories (1 vessel devoted to this following our multi-ship missions)
o Deep coral damage assessment (probably want to conduct this mission once the well is capped
(2) Will request authority to extend the two twin otter missions past their June 15 mission end dates
(3) NOAA findings on Weatherbird II will be formally rolled out on Tuesday in St. petersburg at a joint press event
(4) Science Box is starting to transition its activities towards near term and longer priorities as we get a handle on immediate issues

Fisheries Closures

* There was a slight modification to the closed area in the Gulf EEZ for June 07, 2010, this modification goes into effect at 6pm EST
    - o We are retracted the northeast closure boundary to 86˚20”W to open a portion of the area closed on June 5 based on trajectory data.
    - o The total federal fishery closure now measures 78,264 sq mi (202,703 sq km), or about 32% of the GOM EEZ, a decrease of 135 sq. mi.
    - o The map of the new area is attached.

Seafood Inspection

* SIP personnel will hold their next State sensory training tomorrow in Pascagoula, MS. After that a small crew of four will be available for surveillance activities.
* Three NWFSC staff left for Pascagoula, MS on June 6 to work with NSIL staff to process fish and shrimp for chemical analyses.
* NWFSC is continuing chemical analysis of oyster, shrimp, snapper and croaker tissues.
* NWFSC outlined the plan for development of a relational database to report data from chemical and sensory analysis of fish and shellfish. Data will need to be collected from SEFSC, SIP, NSIL and NWFSC to populate the database.
* Preparing to host approx. 20 State personnel in DWH taint sensory training starting tomorrow.
* Working out logistical problems with SEFSC on obtaining GIS mappings of sampling locations vs. cruise tracks in order to facilitate combining seafood species samples from nearby sites into amounts needed to perform sensory analysis on.
* Working on scheduling of SEFSC Fisheries Scientist availability to taxonomically id previously collected but unidentified DWH seafood specimens.
* Friday afternoon (6/4/10) provided demonstration of DWH seafood sample receipt and processing for Dr. Lubchenco and staff.
* Friday afternoon (6/4/10) provided demonstration of DWH taint sensory analysis protocols and procedures for Dr. Lubchenco and staff.
* The complete seafood safety report is attached.

Marine Mammal and Turtle Health and Stranding

Daily Conference Call held for all Interested Congressional Members and Staff * USCG gave an overview the response assets in place now and oil collection measures underway * MMS provided a status update on the well head containment efforts and of the two relief wells * NOAA provided the current weather conditions and trajectory outlook for the next 3 days and of today's Gulf of Mexico fishery closure modification * Rep. Bill Cassidy participated, as well as staff from a number of Congressional offices including Rep. Gus Bilirakis (R-9th, FL), Senator Jeff Sessions (R-AL) and Senator Roger Wicker (R-MS) Congressional Staff Call This Thursday on the State of Science * Working to set up a conference call for this Thursday afternoon for all interested Congressional Members and Staff that would provide an update on the state of the science regarding the oil spill (e.g. ecosystem-related issues, etc.) Upcoming Congressional Hearings - Week of June 7 - 11 * Wednesday, June 9th: House Science and Technology Committee, Energy and Environment Subcommittee Hearing on "Deluge of Oil Highlights Research and Technology Needs for Effective Cleanup of Oil Spills" (NOAA Witness: Doug Helton, NOS/OR&R) * Thursday, June 10th: House Natural Resources Committee, Insular Affairs, Oceans, and Wildlife Subcommittee Hearing on "Ocean Science and Data Limits in a Time of Crisis: Do NOAA and the Fish and Wildlife Service Have Resources to Respond?" (NOAA Witness: Dave Westerholm, NOS/OR&R)
Issued news release - NOAA Opens 339 Sq. Mile Fishing Area in Gulf Drafting release announcing P3 air chemistry flights - target Tues. Drafting release announcing USF Weatherbird II mission results subsurface oil - target Tues. Refining ERMA / GeoPlatform.gov site and rollout plan - target Thurs. Refining seafood safety rollout plan - target TBD
Planning: External Affairs submitted an outline to David Kennedy for the strategic external affairs plan. External Affairs continues to work with Sea Grant to build our capacity for reaching out to Gulf communities and to the academic sector. · Field Meetings in the Gulf: Met with Charlene Lee and Wendy Allen from SmartCoast in Fairhope, AL. Discussed need to create opportunities for communities to participate in protection of communities. Also discussed importance of long-term rebranding of not only seafood but Gulf tourism as well. Discussed importance of interagency coordination on issues related to coastal community resilience. · Interaction on volunteer program: External Affairs was contacted again by BP over the weekend. They have an update on a new agreement BP has reached with Gulf states on training and use of volunteers. Winer and Madsen will discuss ideas from Winer's trip week of 5/31 and will discuss next steps with BP's volunteer coordinator. · Complaint emails: External Affairs received 12 new emails with complaints re the oil spill. Topics of concern: Two emails were critical of trajectory maps because they show cities that are not on the coast where few people live instead of more recognizable cities on the coast (like Panama City, Destin). One e-mail asked if rescued birds are being tagged. Others were from constituents venting anger about NOAA and EPA. · Mass Notifications: Sent notification of a modification to the fish closure area in the Gulf - retracting a portion of the last modification made on Sat. June 6.

Attended conference call with OMB (deputy Fed CIO) and Federal geospatial leadership all very positive about geoplatform.gov, but OMB noted potential challenge with large number of concurrent web site users resulting in blocked access to the site. · Discussed options with DOC New Media Office for improving public usability of data on geoplatform.gov., and refining web page messaging.
1. ICC Tasker #179: Dr. Porfirio Alvarez (Mexico) responded positively to OIA's interim response sent last week regarding a possible meeting with Dr. Lubchenco while he is in Washington (June 15-17). Dr. Alvarez understands the state of flux in her schedule. He also did provide a cell phone number for quick contact in the event of a sudden opening in her schedule. Will monitor schedules at the end of this week to see what, if any, opportunities can be considered. 2. Received call from NOAA/Leg. Affairs regarding a Congressional question about international outreach by NOAA regarding seafood safety. OIA attempting to get more details. 3. Chefs who will be participating in the Great American Seafood Cook-off in August in New Orleans will be in Washington this week for the NOAA Fish Fry. NMFS is facilitating a meeting with OIA, which in turn is reaching out to ITA, EDA, and USDA/Foreign Agricultural Service to discuss seafood safety and Gulf seafood exports. **Key Bullets** • Working with LA to get more details on a Congressional question about NOAA's international outreach • Have cell phone contact information for Dr. Porfirio Alvarez in the event Dr. Lubchenco has an opening to meet with him next week. • Continuing efforts to prevent safe Gulf seafood exports do not lose competitive position with world class chefs, ITA, EDA, and USDA/FAS.
NO UPDATE
NO UPDATE

TASK	DEADLINE
litigation hold on all documenets	on-going
talking points/on-pager Impacts to marine mammals and turtles	4/27/2010
Fisheries report and economic statistics	4/28/2010
Role, Schedule document	4/29/2010
Email Distribution List	4/29/2010
fishery closure disaster FAQs (can fishermen receive compensation near real-time?)	4/29/2010
Request for economic impacts to fisheries	4/29/2010
fisheries issues white paper as relates to spill	4/29/2010
Develop a long-term staffing plan	4/30/2010
White House White paper - OCS and OSLTF	4/30/2010
Develop plan for ICC to be 24 hrs	4/30/2010
Use of Satellite Imagery	4/30/2010
oil spill impacts, hurricances, and other weather systems	4/30/2010
provide trajectory information to DOT	4/30/2010
List of NMAO vessels in area	4/30/2010
Impacts to NOAA equipment (tide guages, etc)	4/30/2010
Unified Command locations	4/30/2010
Map of NOAA facilities in area	4/30/2010
contact info to send new ideas/technologies	4/30/2010
Worst Case Scenario briefing for Deputies	5/1/2010
assessment of historical weather in Gulf	5/1/2010
Prioritized list of Congressional of overflights	5/1/2010
policy decision -economic implications for WH	5/1/2010
Winer to serve as POC for NGO engagement	5/1/2010
Resources at Risk and accompanying FAQs about roles responsibiliites, and what we are actually doing	5/1/2010
follow-up with UNH science contacts, particularly in relation to dispersants	5/1/2010
one-pager biological impact from sheen and dispersants	5/2/2010
NOAA role in oil spills	5/3/2010
Turtle talking points	5/3/2010
legal record of use of dispersant at source	5/3/2010
work force mgt explore how to engage support of other agencies, states, etc	5/3/2010
Contingency Plan for Gordon Gunther	5/3/2010
Official Tasking for vessel allocation	5/4/2010
Loop Current Tps	5/4/2010
Verify NIST engaged in specimen collection	5/4/2010
understanding of safety of environment	5/4/2010
Safety of staff working on the ground	5/4/2010
catch & release in closed area tps	5/4/2010
recreational & commercial fishing data	5/4/2010
NASA to provide high spectral imaging	5/4/2010
Legal questions for response to Governors	5/4/2010
LO engagement training fishermen	5/4/2010
loop current factsheet	5/5/2010
High level worst case tps	5/5/2010

worst case web-ex meeting	5/5/2010
partner with google on product	on-going
NMFS updated info available for Govs. Calls	5/6/2010
best case scenario	5/6/2010
Request from DOI for assistance in chain of custody, storage procedures, laboratories that can do anaylysis, etc.	5/6/2010
Review EPA Dispersant Q&A	5/7/2010
info on how volunteers can get involved	5/7/2010
mechanism for small grants to academics	5/7/2010
Briefing for Francis Beinecke, CEO NRDC	5/7/2010
industry validator list for efforts in Gulf for Adm Allen phone call on 4/9	5/8/2010

Q&A on Sea Food Safety - NOAA/FDA authorities, roles, on-ground coordination, NMFS	5/9/2010
Assess NOAA to serve as lead for SCATs	5/9/2010
Compacted oil bricks collected at Dauphin Island, what NOAA scientist received, what info is known	5/9/2010
NOAA all hands message on gulf	5/9/2010
Rep. Cassidy requested info on testing/monitoring of the impacted fisheries areas and how it is determined what areas should be closed (or re-opened) and how that information is relayed with the public.	5/9/2010
analysis of "red-tide" samples	5/9/2010
NOAA Research Council oil and science coordination across NOAA; outcome actions for team and Larry Robinson	5/9/2010
Gov. LA request to dredge and fill for keeping oil off-shore	5/9/2010
follow-up on cooperative MOU and BP science sharing, and ability for contract academic scientist to share data	5/10/2010

Identify NOAA Scientist to serve as lead for our scientific activities and liaison for the academic community	5/10/2010
Follow up with MS and AL regarding fisheries closure. NMFS has call today with State Directors	5/10/2010
subject matter expert briefings	5/10/2010
Ensure we are adequately ramping up our capacity to analyze seafood safety issues	5/10/2010
Review DOS Embassy cable	5/10/2010
OMB request that NOAA serve as Federal lead for Deepwater Horizon consolidated website	5/11/2010
Provide guidance to staff regarding tracking hours, expenses, etc in relation to this event	5/11/2010
NOAA SSC /RRT efforts to host workshop on dispersants, region-wide assessment, impacts, long-term fate, etc.	5/11/2010
Seafood Sampling plan details for DOC	5/11/2010
Fisheries Disaster Declaration – Apparently the Governor sent a letter to Sec. Locke on April 30 seeking a disaster declaration for MS fisheries due to the leak. They have not heard anything about their request and asked for a status update.	5/11/2010
Process for forwarding funding requests to Unified Command or other leads	5/12/2010
Move proposals for IOOS HFR and second flight of P-3 through approval process	5/12/2010
Prepare request to Mary Landry regarding NOAAs research/scientific requests, ceiling of requests, and streamlined process for making requests	5/12/2010
Guidance for staff on congressional town halls, local/regional meetings with congress – ensure consistent messaging	5/12/2010
Request rough estimate for number of NOAA staff in the region, distinct from those on TDY	5/13/2010
Follow-up today for science coordination across NOAA and engagement/coordination with Navy	5/13/2010
Request for time on aircraft for NMFS enforcement	5/13/2010
Follow-up regarding interview scheduled for today in Houma	5/13/2010
Media protocol – work through Office of Communications and External Affairs on all media requests.	5/13/2010

External constituent engagement protocol – work through appropriate offices: Office of Communication and External Affairs and o Office of Legislative and Intergovernmental Affairs	5/13/2010
When you meet with external groups, please send a brief report out of the meeting and interests of the public (all)	5/13/2010
Barrier Island fill-in follow-up today, ensure Habitat Office is engaged; host call today with NOAA HQ and staff ASAP today (5/13)	5/13/2010
Request for data on normal numbers of turtle and dolphin strandings/deaths for the longest historical data	5/13/2010
Follow-up on flow-rate estimates	5/14/2010
NOAA needs to step out in a stronger way regarding our science and examining the whole ecosystem; air quality and water quality.	5/14/2010
Utilize Sea Grant more effectively to serve as our liaison for engaging with the community	5/14/2010
Engage external scientific community to validate video's from BP	5/14/2010
ADML Landry request 30-day ship time, use of the Gordon Gunther	5/15/2010
Overview of sampling that is not being done, broad issues related to understanding where the oil is and what its impact is (all assets, not exclusive to NOAA assets) Requested to send this to the NIC	5/15/2010
Clear Daily report on status of marine mammals and turtles	5/15/2010
Create daily chart showing mortality in relation to: #of total dead turtles, # sent for necropsies, # necropsies completed, and # dead due to oil.	5/15/2010
Assess capacity to conduct work needed – request to review this and if more people are needed	5/15/2010
develop timeline of seafood safety testing in advance of Monday Meeting/call at WH	5/15/2010
Ensure routine updates on 0800 calls on key issues NOAA is working on	5/15/2010
Ensure clear lines of communication and updates between NOAA and NIC	5/15/2010
Reconstruct process of how NOAA has been engaged with developing/communicating release rate	5/15/2010
Contact sheet for where to refer constituents to for key information	5/15/2010

Strategies to communicate our issues, particularly NMFS closures to public	5/15/2010
Assign lead technical expert for LA barrier island issue	5/15/2010
Check in on monitoring plan regarding use of sub-sea dispersants	5/15/2010
Develop product for what our NERR and NM Sanctuary sites are seeing	5/15/2010
Follow-up on release of chemical contents of dispersants for seafood safety testing needs	5/15/2010
Identify mechanism to follow-up with attendees at community meetings	5/15/2010
Follow-up on NOAA representation at NIC and if Mark Miller and Ralph Lopez need additional support	5/16/2010
Communication plan for loop current, ensure have same story for all constituents. Talking points for leadership	5/16/2010
Move loop current one-pager through clearance ASAP	5/16/2010
Change loop current map: oil portion stippled to indicate that the oil is not uniform across the spill, show loop current as a somewhat more varied flow	5/16/2010
Tuesday, 2-3 meeting hosted by OMB for bi-cameral Congressional meeting to review legislation that has been introduced – who should participate on behalf of NOAA	5/16/2010
Formal request needed through NIC for chemical components of dispersants, assistance from GC if needed	5/16/2010
Dispersant Monitoring plan should include efficacy of dispersant on oil, and biological/ecological impacts	5/16/2010
Hurricane outlook interactions with oil spill talking points and Tuesday 8am briefing	5/16/2010
Develop talking points for issue of Pelican cruise and scientific statements asserted in press	5/17/2010
Line Office assess participation in 3 technical working groups that are stood up by the Interagency Solutions group	5/17/2010
Develop proposal for engaging academic community (for review today)	5/17/2010
Reconsider fisheries closure in light of data provided from Pelican cruise. Also conducting random dock-side sampling to ensure seafood safety.	5/17/2010
Expedited review of Loop 101 and Talking Points – internal by 0930	5/17/2010
Expedited review of Long-Term Transport of Oil and Talking Points – internal by 1100	5/17/2010
Follow-up on research platforms that could be deployed and sampling plan from all assets	5/18/2010
Expert briefing for Loop Current	5/18/2010
Histogram by day for turtle strandings	5/18/2010
Request for talking points for turtle strandings	5/18/2010
Precautionary closure of fisheries due to potential of oil in the loop current	5/18/2010
Assign technical point for OMB, DOC, FDA group regarding seafood safety; .	5/18/2010
Need to have talking points and alert Cuba and Mexico regarding fishery closure and potential of oil in loop current	5/18/2010
Alert WH of fishery closure change	5/18/2010
Talking points on loop current, fishery closure, international, states – what we are doing to address the potential that oil is in the loop current	5/18/2010
PLEASE clearly note on all emails and documents if they are FOR INTERNAL USE ONLY	5/19/2010
Check-in with Michele Finn regarding assets available on the ground, consider requesting Navy support	5/19/2010
Talking points on activities underway in Sanctuaries and NERRs	5/19/2010
NOAA daily update, NOAA by the numbers, what NOAA has done for the day	5/19/2010

Do not provide economic data; contact Patricia Buckley (pbuckley@doc.gov) and Mark Doms (mdoms@doc.gov) for questions and cleared economic data	5/19/2010
Consider if the new Loop Current product can be made public and updated as appropriate	5/20/2010
Follow-up call with NMFS and Kennedy regarding particular aspects of seafood safety testing and oil aspects	5/20/2010
Time-line for science plan	5/20/2010
Recirculate oil and hurricane materials	5/20/2010
Step back and assess how we are operating in response to this spill, how can we do a better job in getting information out to the public (data, what we are doing, etc), what resources do we need to	5/20/2010
additional staff needs for ORR Seattle War room, etc	5/21/2010
Joint press release for Gunther and USF sampling cruise	5/21/2010
Notification to foreign nations of potential impacts to their states; need to do this in a timely manner as there are legal considerations	5/21/2010
Follow up on science plans, cruises – note of 7 vessels, request for clear list of vessels and activities	5/22/2010
Hurricane's and Oil Spill fact sheet and talking points, share with Jason Rolfe at the NIC	5/22/2010
Share stories for how the government is adding value to the spill response and associated activities	5/22/2010
Determine how many non-Federal partners NOAA has engaged with this process	5/23/2010
Engage oil spill community and hurricane community to familiarize on data, processes, communication strategies so that if hurricanes occur in the gulf, we can have a coordinated message and approach; include EPA in conversations and follow-up actions	5/24/2010
Consider deploying ORR staff to sit in the NHC to support FEMA on the ground	5/24/2010
Do a briefing for meteorologists on the ground in the coastal states that are prepared with information and talking points regarding oil spill and hurricanes	5/24/2010
Identify what our hurricane response plan is in light of a hurricane, both Unified Command and NOAA assets	5/24/2010
Follow-up for 3pm Oil Spill 101 WH Press Briefing	5/24/2010
Dispersant workshop – provide information on plans, who is invited, etc. for outreach to public and federal agencies, etc.	5/24/2010
Follow-up on EPA water quality monitoring plan, potentially item to be raised at a Principal call.	5/24/2010
Follow-up meeting among science players to ensure tight coordination across NOAA	5/24/2010
Succinct email for where we are on making data public and where that data will be housed	5/24/2010
Roll out seafood safety results this week, ensure is well coordinated	5/24/2010
Berm proposal - usace proposal for berm : NOAA review before noon	5/25/2010
Dispersant workshop at LSU - Planners need to connect Nancy Kinner	5/25/2010
Clear compilation of NOAA and contract cruise activities	5/26/2010
Review materials that are distributed daily and streamline	5/26/2010

Resources for ensuring ERMA/data information can be operational ASAP; request from other bureaus and departments for servers and hardware needs while we wait for equipment to arrive	5/26/2010
Follow-up on discussion regarding data compilation and peer review considerations for data	5/26/2010
clearance for posting on erma	6.5.2010
clearance process for factsheets, tps, etc	6.4.2010
ERMA: Data descriptions NOAA delivering to the public through geoplatform.gov.	6.4.2010
Talking pts/materials for dr. lubchenco for 6.7.2010 potus briefing on dwh	6.3.2010
intro speech for dr. lubchenco's chow presentation	6.3.2010
Need POC for Smithsonian offering to work with NOAA: 370,000 marine collections from the Gulf. They are deep ocean specimens from areas right around the oil spill. Result in a sense of relative abundance, and might provide a helpful basline. Jonathan Coddington (CODDINGTON@si.edu) lead for SI	6.5.2010

LEAD	Status
ALL	On-going
NMFS	Completed
James	
Dieveney	Completed
Love	Completed
NMFS	Completed
NMFS through ICC	Completed
Moore	
Lukens, Bavishi, Holst	Completed
Moore	Completed
Holst	Completed
NWS	Completed
ICC	Completed
Taggert	Completed
Moore	
Holst	Completed
Taggart	Completed
ORR	Completed
Conner, Helton	Completed
NWS	Completed
Gray, Bagley	Completed
Doremus	
Winer	On-going
NMFS	Completed
kennedy request	Completed
Holst	Completed
Holst	Completed
NMFS	Completed
ORR	On-going
Taggart	
OMAO	Completed
Conner	Completed
ORR Seattle	Completed
ORR	need follow-up
Broglie	On-going
Nyr B	On-going
NMFS	Completed
James, Plummer	
Glackin	Completed
Schiffer, GC	Completed
PCO	Completed
ORR Seattle	Completed
Holst	Completed

Conner	OBE
Klimavicz, Akamine	On-going
NMFS, Rapp	On-going
Conner	Completed
NIST/Pedro Espina	
Holst, ORR	Completed
Madsen	Completed
	On-going
Winer	
Winer	Completed

NMFS	
Conner	Completed
Conner	Completed
Kenney	completed
OLA/NMFS	Completed
ORR	
Murawski	Completed
Bavishi	
Schiffer, GC	

Kennedy/Glackin/ORR	completed
NMFS	Completed/but continued engagement needed
Comms with JIC	On-going
Murawski/Thompson	
DWH, ORR	Completed
Sarri to follow-up with OMB, Klimavicz	
Gallagher/all staff	Completed
conner	in progress
NMFS	draft developed
NMFS	
ORR/Gallagher	
ORR/OAR/Gallagher	
ORR/Gallagher	
Gray, Bagley	
Taggart	Completed
Murawksi as lead, Zdenka,others	Completed
Oliver/Kenul	
Kenney/Westerholm/Conner	Completed
All staff	On-going

All staff	On-going
All staff	On-going
Yozell	On-going
NMFS	outstanding
Murawski and team	
McLean, Winer, Kennedy, Murawski	
Beaverson	
Kenul/westerholm	Completed
Murawksi and team	
ORR/ICC	
NMFS	
NMFS/ORR	
NMFS	
Dieveney/Kennedy	On-going
Dieveney/Westerholm/Miller	On-going
ORR-Seattle	
Dieveney/Winer team	

Sutter/Winer	
Yozell	
Westerholm/Henry	completed
NOS	On-going
Kennedy/Westerholm	outstanding
McLean/Winer/Bamford/Gray	
Miller with leadership	
Kenney	Completed
Murawski/Dieveney/leadership clearance	Completed
Haddad	Completed
Gray	
Tim Gallagher	
Tim Gallagher	completed
NWS	completed
Kenney/McLean	Completed
LO Leadership	
Murawski/Sandifer/Haddad, others	draft submitted 5/17
NMFS	Completed
HQ clearance	Completed
HQ clearance	outstanding
Murawski/McLean	
Kenney	
NMFS	
NMFS	
NMFS	
NMFS	
Sarri	
DWH Team with experts	completed
ALL	On-going
DWH Team	
DWH Team	
Kenney	underway

ALL	On-going
Conner/Kenney	review on-going
Oliver, Kennedy	Completed
Matlock, Murawski	
DWH Team	Completed
All, also particular to NOAA HQ	on-going
Taggart	
Kenney	
Turner/Reed with DWH Team	On-going
Gallagher	
NWS and ORR	in progress
Comms/DWH staff team	On-going
ICC RFI	
NWS/ORR	
ORR	completed
NWS/ORR	
ICC	
Kenney	Complete
Gray/Kenney (Dreyfus)	
(Rolfe at NIC/Westerholm)	
Kennedy	
Klimavicz	Completed
Comms/ NMFS	
policy/NIC	completed
Comms	completed
Science/Assets	
ICC/DWH staff	

Data & Information	
Science	
margaret spring	
comms	
Amy Merten	
DWH Staff	
DWH Staff	
NRDA / Penn	

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Outcome	NOTES
questions from WH	
Submitted through JIC process, not a NOAA product	
briefing to take place on 5/18	
http://www.charts.noaa.gov/ENCs/?M_D	
map is now created periodically showing all NOAA assets in the region	
map is now created periodically showing all NOAA assets in the region	
map is now created periodically showing all NOAA assets in the region	
Have one-pager with info for use	
one-pager developed and sent for clearance on 5/17	
being coordinated through Unified Command	
External Affairs team in place to support	
cleared and posted on-line	
request to engage UNH through the science summit proposal and engaging academic scientists	
complete and posted on-line	
requested by GC	
working on IPA	
BP not requesting	
BP not requesting	
5/7 version completed and available for use internally	
what is NIST concern?	
Birnea to travel 5/10 to review situation and develop a plan	
vendor AIRINC could also serve this role	
info sent to John Rapp for use	
completed, needs to be posted on-line	

Dr. L to call google colleagues to follow up www.google.com/crisisresponse/oilspill	
will be built into every days tps	
Experience tells me that the response would go on for 45-60 more days, but the oil will all be beached or dispersed within about 30	
Pedro to close loop with NOAA and DOI	
Need to have final Q&A	
On the guidance for volunteer issue, Caren and I are working with BP's volunteer coordination program coordinators to establish a protocol for providing information to BP about organizations that have volunteer resources and organizations in the Gulf that are capable of accepting volunteers. Based on my discussions, BP should be ready to discuss these protocols by Wednesday/Thursday, and we are planning a call with BP's volunteer coordinators and the external affairs working group organized by CEQ. In addition, the Fish and Wildlife Service and NOAA are working together to take the various lists of entities offering volunteers and organizations in the Gulf seeking volunteers and create a working document. After we determine the best way to interface with BP, we will likely send the document to JIC and get approval to share it with BP.	
there is a mechanism in place (LA Sea Grant), for which funds if available could always be added, other regional Sea Grants following suit. Sea Grant should be included in the suite of granting mechanisms engaged, but not be sole route	
To follow-up with Michele Finn to identify SSC or other to brief	
list sent to Justin on Sat. No known outcomes from Adm Allen phone call	

	Mussel Watch (John Christensen in NCCOS) is sampling for chemicals in shellfish along the coast to establish new base lines before oil hits and will be testing during and after spill hits shorelines. It is nation's longest continual water quality/shellfish monitoring program.
Determine that we could coordinate Federal participation on SCAT (as of 5/10/10: 4 out of Houma; 5 out of Mobile)	
analysis shows this is from Mississippi 252; likely sourced from initial blast	
sent with notice of confirmation of AS Dr. Larry Robinson	
Talking points cleared and delivered	
Analysis being done 5/10 by LUMCON, should have information today	NCCOS scientists (Rick Stumpf) on what red tides/ algae they have IDed in Gulf.
activities on-going to engage scientific community across NOAA and external partners	
call taking place on 5/12 (EPA, NOAA, DOI)	

Gary Matlock - intra-agency; Murawski - interagency; Sandifer - academic liaison	
NMFS has call today with State Directors	no specific criteria they are using NOAAs 3 day traj's like us
Disperants, Hurricanes, Seafood Safety, etc.	Dispersants (5/12)
NMFS text has been provided regarding fish closures and seafood safety	
contact made to DOC CFO to take action to follow-up with OMB to make a formal request of Randy Lyon, Randolph M. Lyon@omb.eop.gov, and ask about a possible DOC leadership role perhaps through multi-agency coordination with SBA to explore further what is required for physical one-stop locations.	Deepwater Integrated Services Team led by Tracy Wareing, DHS, and Daniel Werfel, OMB. Leon Cammen, NOAA Sea Grant,
guidance distributed on 5/12	
Charlie Henry is trying to push forward with this using BP funding. He requested that Dave Kennedy support the concept to BP while he is in Louisiana. We should also start to support the idea in NRT calls and discussions with EPA.	
Meeting with OMB, DOC, and FDA Monday, 5/17	
FTEs in 5 regional states: 1400; within 20 miles of coastline: ~750	
activities on-going	
interview was canceled	
Contact: Justin Kenney (justin.kenney@noaa.gov), Scott Smullen (Scott.smullen@noaa.gov) and Jennifer Austin (Jennifer.austin@noaa.gvo).	

Office of Communication and External Affairs (Andy Winer: Andrew.winer@noaa.gov); Office of Legislative and Intergovernmental Affairs (john.gray@noaa.gov)	
send to Andrew.winer@noaa.gov and dwh.staff@noaa.gov	
meeting happening in region today: rachel sweeney, pat williams to participate on behalf of NMFS	
data received by NMFS on 5/17, in process	
(updated 5/14) WHOI scientists are capable of deploying instruments on one of the working ROVs. We discussed making multiple acoustic measurements to assess the degree of variability. This looks to be doable	NIST: Flow Metrology Group and the POC there is Pedro Espina (pedro.espina@nist.gov, 301-975-5444)
Regional meeting with all Sea Grant Directors scheduled for Monday, 5/17	
request for longer piece of video is still outstanding (5/17)	
Identify what other NOAA/academic assets has that are comparable; o Connect with Unified Area Command to determine needs and how needs could be met by other NOAA /academic assets	USCG is using contract vessel. No need for NOAA to reallocate the Gunther (reported on 5/17)
Request from WH Principals meeting on 5/14 - note that if more resources are needed we should ensure we have them	
Report for daily situation report	
Request from WH Principals meeting on 5/14; DoI requested to do same for birds	
Request from WH Principals meeting on 5/14 - note that if more resources are needed we should ensure we have them	
NOAA contacts at NIC: Mark Miller (mark.w.miller@noaa.gov); Ralph Lopez (ralph.lopez@noaa.gov)	

Has polled team for technical expert engagement (Miles Croom, Chris Doley, others)	
Contact made to NERR and ONMS on 5/14 for follow-up	
NOAA NIC contacts tracking this down today 5/14	
assessing additional full-time science staff	
Spring/NMFS(Reisner)/NOS (Westerholm and Kennedy)	
will be given to team on 5/18	
Proposal from Mark Miller: Discharge Rate technical team – potential participants: Dr. Bill Lehr, OAR (Dr. Ned Cokelet, PMEL); • Loop current team – potential participants: Dr. Jerry Galt, Dr. Rich Patchen (Environmental Assessment Group has also taken this issue on); • Subsea Dispersant Characteristics – potential participants: Dr. CJ Beegle-Krausen, Dr. Alan Mearns	
verified that the area in which the Pelican was working is within the closed area	
JIC cleared (5/17) OMB/WH pending	
Closing larger area of fishery will be announed 1300 today, in effect 1600 today	
Steve Wilson and Tim Hansen can serve this role	
press briefing on loop current conducted 5/18 at 1100.	
request out to Los to submit data every day	

contact Patricia Buckley (pbuckley@doc.gov) and Mark Doms (mdoms@doc.gov) for questions and cleared economic data	
determined product as is is not appropriate for public dissemination, conversations between D.Miller and Helton underway	
sent with notes from call	
updated document outlining leadership response structure	
Tick-Tock of NOAA assets on the ground developed (5/23)	
Jerry Galt identified to serve this role	
Have slide deck used for this press briefing	
Comments on plan postponed to noon 5/24	
NOAA's principal web engineers worked through this past weekend and are continuing to install additional hardware to allow this effort to become a reality. We are limiting access to this development/test portal to speed development. I thought we would be able to allow access to a few users to preview the site today, but given where we are with development, we will try to give some access tomorrow to NOAA leadership. Concerning the consolidated approach to Deepwater data, this development (public ERMA or GeoPlatform.gov) addresses the ability to integrate all of NOAA's data, as well as other Government agencies (DOI, EPA, DHS)	
comments submitted 5/25	

NOAA Science
Situational Awareness Briefing

Deepwater Horizon MC252

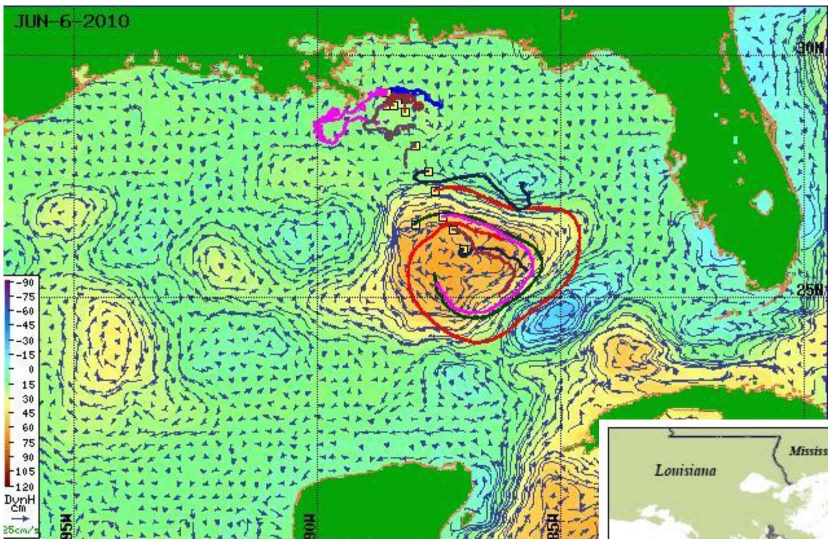
June 8, 2010

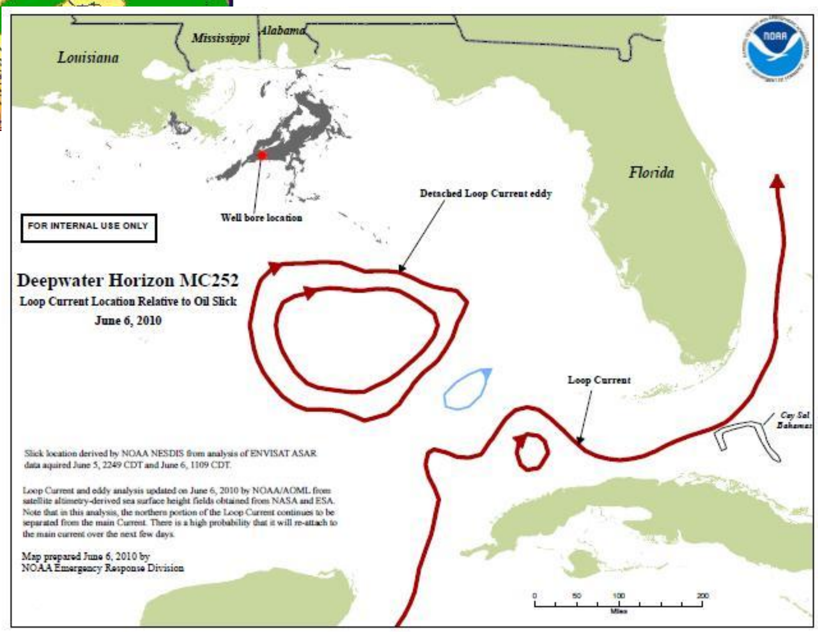
EXPERIMENTAL PRODUCT
** For Internal Use ONLY **

Topic Areas

- Loop Current Dynamics
- Protected Species Status
- Seafood Safety Sampling
- NOAA Assets
  - Planes, Vessels and Charters
  - IOOS

Loop Current Discussion for June 7, 2010

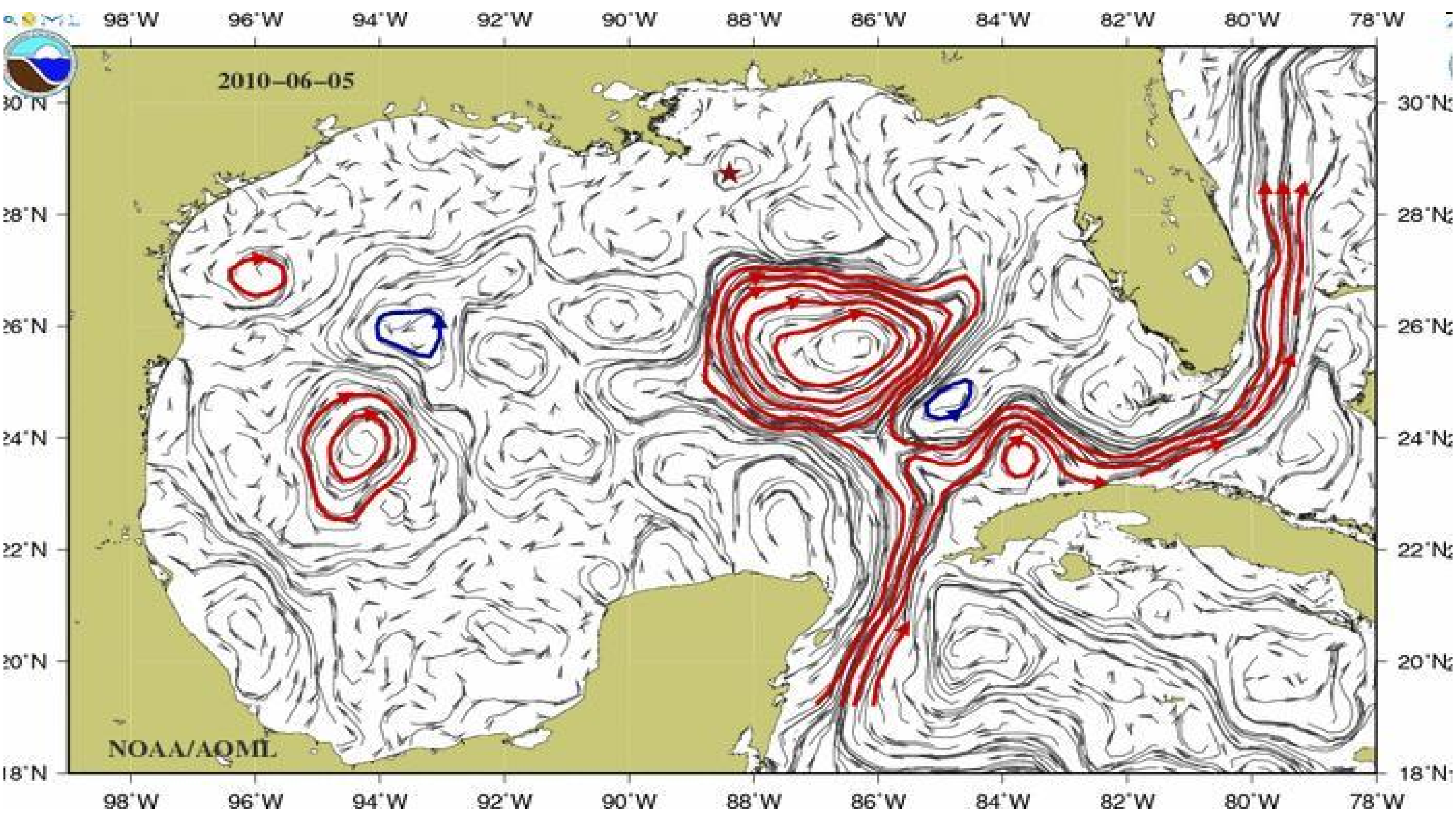




*There is still indication that the gap between the northern eddy and the main part of the Loop Current is narrowing, however it is too soon to draw conclusions from this.

*Continued potential for reattachment in the next few days to weeks.

*Buoy tracks (shown as colored lines in above picture), continue to remain moving clockwise within the northern eddy



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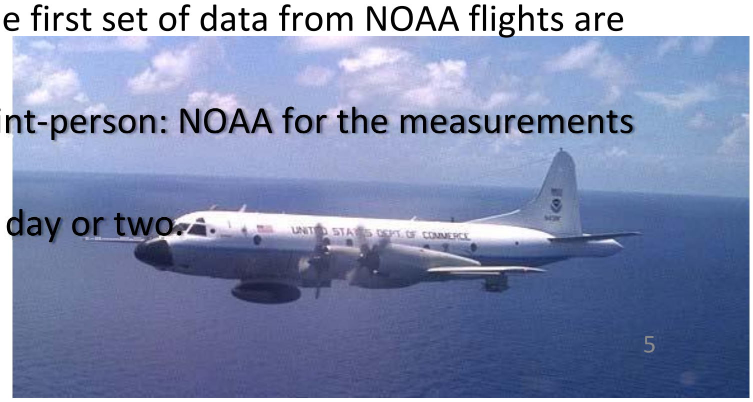
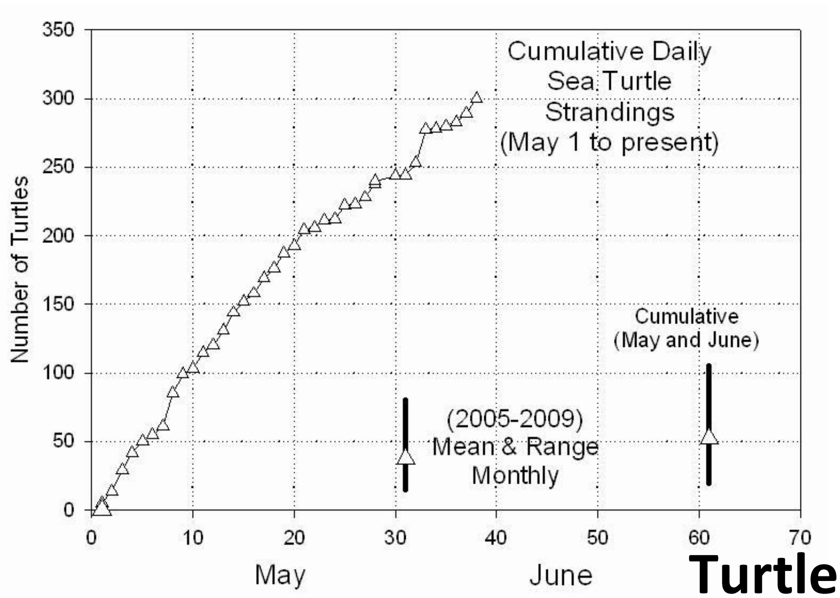
Air Quality
EPA and NOAA discussion re: NOAA P3 aircraft

- NOAA P3 will transit to Tampa today, Monday June 7, 2010 and fly a mission, if every thing goes well, on Tuesday. This aircraft will operate both within and outside the Marine Boundary Layer. It will examine emissions close to DWH rig and other parts of the oil spill. ASPECT will do its regularly scheduled flights on Tuesday.
- Intercomparison will be carried out later. Such inter-comparison could be done by flying in the proximity at appropriate times and it is not essential to have the two aircraft flight simultaneously in the same air mass.
- EPA data is already available on the web and has public access. NOAA needs to work out its data sharing policy since it involves partner from universities. However, data will be shared freely using password protected ftp site between NOAA and EPA scientists.
- NOAA and EPA scientists will talk as soon as the first set of data from NOAA flights are available.
- Agreed that we should have two people as point-person: NOAA for the measurements from P3 and EPA for ASPECT and toxicology.
- Further details will be forthcoming in the next day or two.

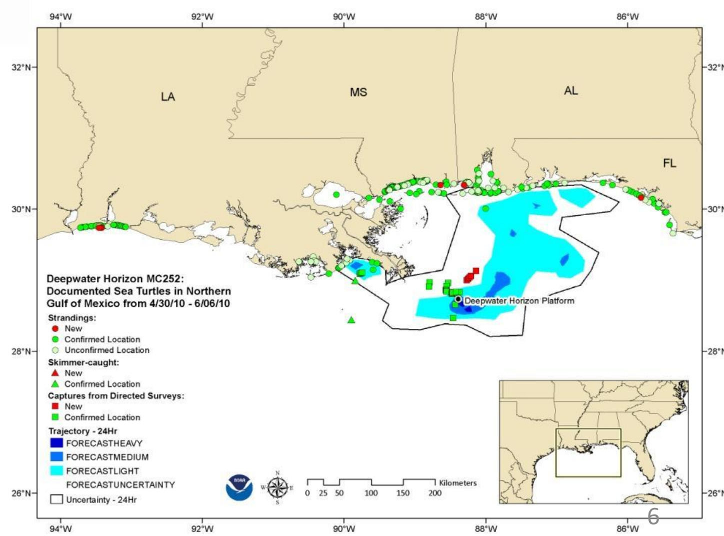


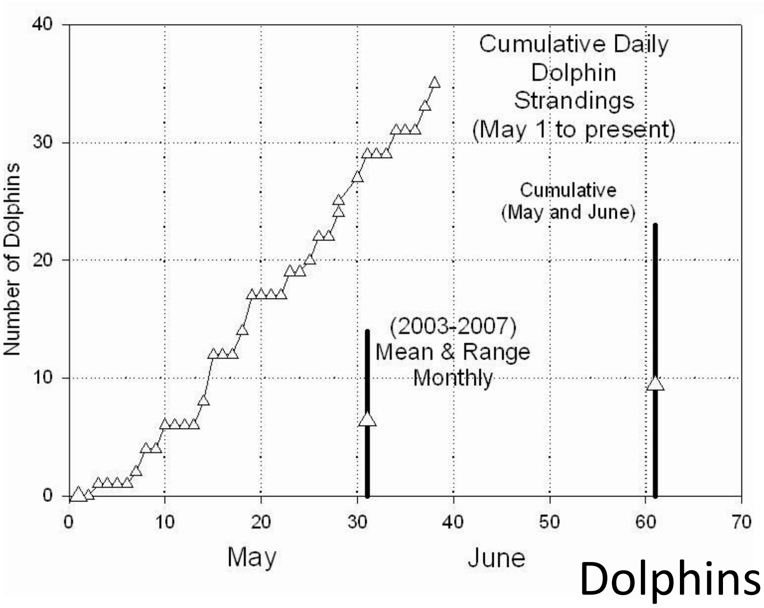


Turtles

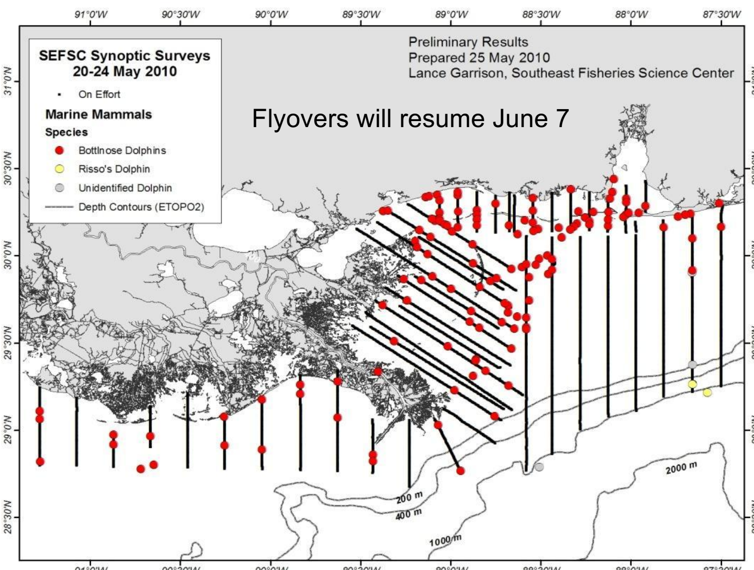
Live, oiled Kemp's ridley recovered from convergence/oil areas 1 June 2010.

Turtle Status	
Total Verified Stranded Turtles	**300**
Total stranded turtles found dead	250
Total live stranded turtles currently in rehabilitation	41
Total live stranded turtles that died in rehabilitation	6
Total live stranded turtles released	3
Turtle Necropsy Status (of dead animals)	
Number assessed and unable to perform necropsies (e.g., advanced decomposition)	7
Number of partial necropsies performed (e.g., due to scavenging or autolysis)	17
Number of full necropsies performed	53
Verified strandings but animals not collected due to stage of decomposition or unable to recover	46
Carcasses to be necropsied, if decomposition stage warrants	133

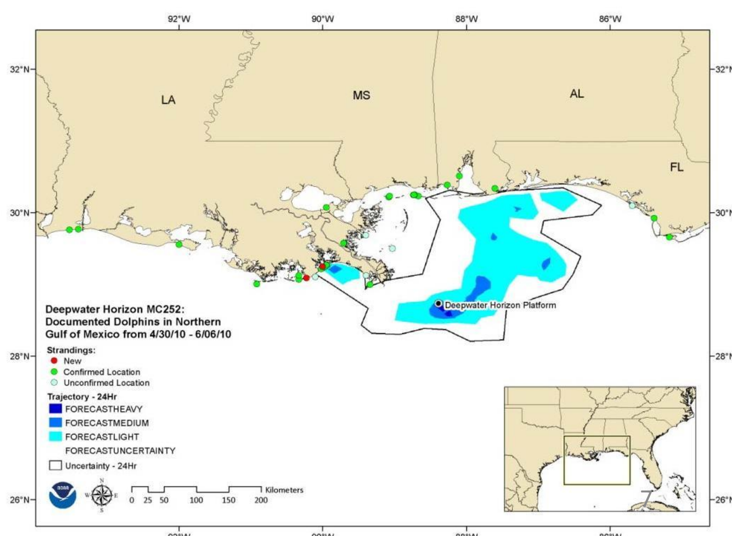


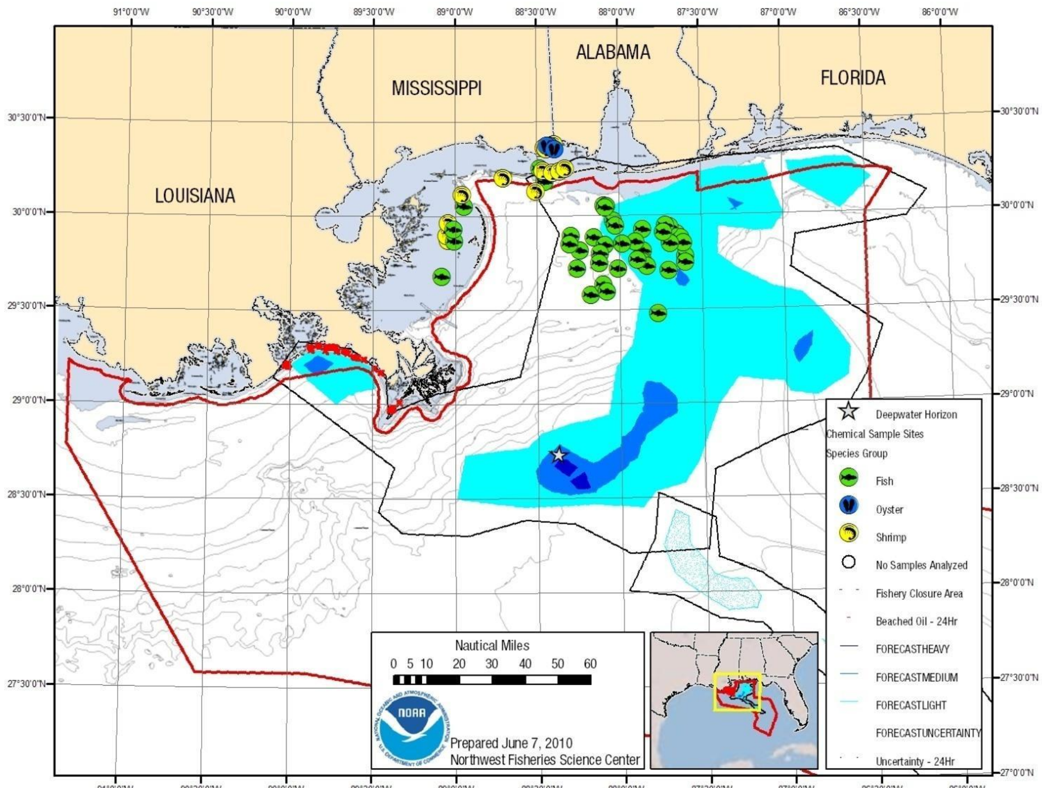


Dolphins



Dolphin Status	
Total Verified Dolphins	**35**
Total dead stranded dolphins	33
Total live dolphins currently in rehabilitation	0
Total live dolphins stranded that died in care	2
Total live released dolphins	0
Dolphin Necropsy Status (of dead animals)	
Number assessed and unable to perform necropsies (e.g., advanced decomposition)	12
Number of partial necropsies performed (e.g., due to scavenging or autolysis)	7
Number of full necropsies performed	6
Verified strandings but animals not collected due to stage of decomposition or unable to recover	8
Carcasses to be necropsied, if decomposition stage warrants	2





June 7, 2010

- 3 Center staff are at NSIL in Pascagoula, MS to process fish and shellfish samples for transfer to the NWFSC for chemical analyses.
- GC/MS results of 13 fish samples (muscle composites) collected from areas closed to fishing passed QA/QC and are posted on the NWFSC website [results summarized on next slide]--concentrations were well below levels of concern.
- Additional sets of fish, oyster, and shrimp samples (composites) from existing inventory are currently being prepped for GC/MS analysis.

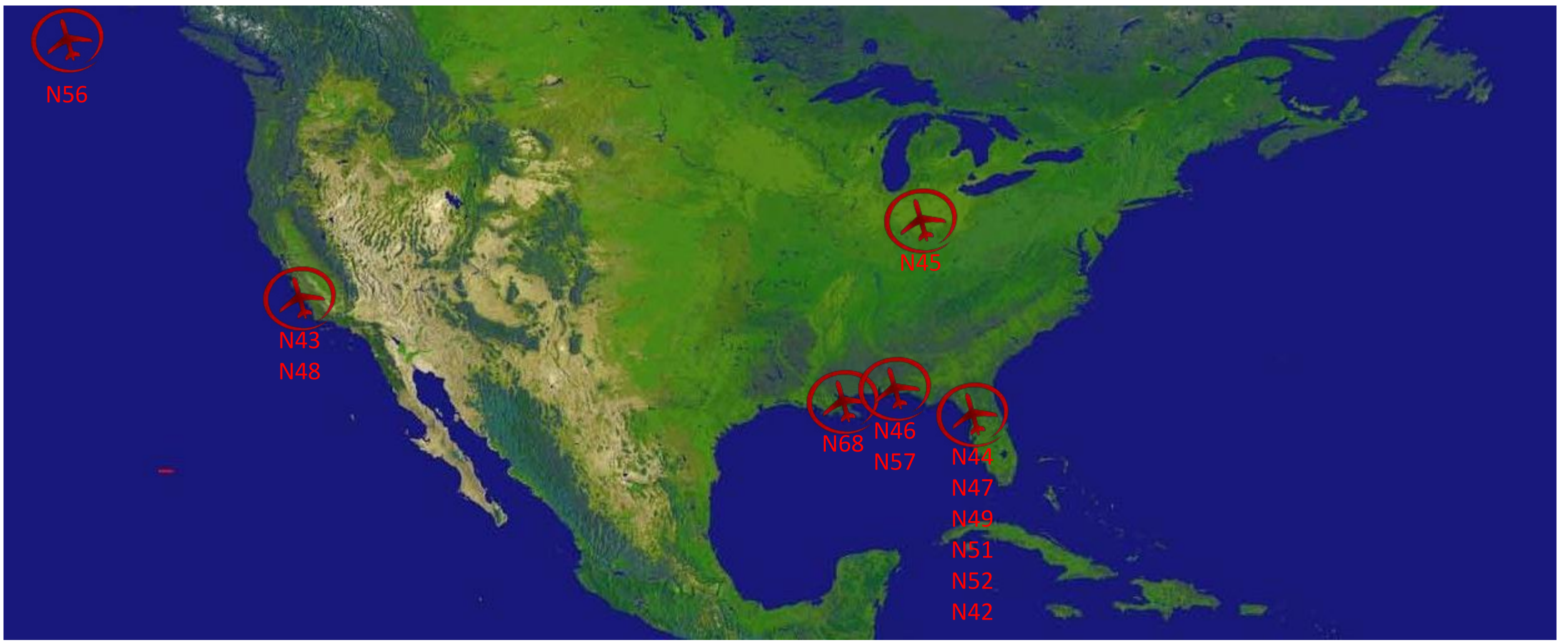
Concentrations (ng/g, wet weight) of selected polycyclic aromatic hydrocarbons measured in edible tissues of fish collected in the Gulf of Mexico region as part of the Deepwater Horizon MC Canyon 252- Seafood Safety Response 2010

Species	Sample Type	Site	Collection Date	FLA	CHR	BaP	BAA	PYR	HMWAHs	LMWAHs
Lane Snapper	muscle	BR 1001 052010 012/512	20-May-10	<0.13	<0.21	<0.19	<0.19	<0.13	< LOQ	3
Lane Snapper	muscle	BR 1001 052010 013	20-May-10	<0.14	<0.23	<0.21	<0.20	<0.14	< LOQ	1.8
Red Snapper	muscle	BR 1001 052010 013	20-May-10	<0.13	<0.22	<0.20	<0.19	<0.13	< LOQ	2.8
Red Snapper	muscle	BR 1001 052110 014	21-May-10	<0.14	<0.24	<0.21	<0.20	<0.14	< LOQ	3.3
Lane Snapper	muscle	BR 1001 052110 014	21-May-10	<0.13	<0.22	<0.19	<0.19	<0.13	< LOQ	2.9
Lane Snapper	muscle	BR 1001 052110 015	21-May-10	<0.13	<0.22	<0.19	<0.19	<0.13	< LOQ	2.1
Red Snapper	muscle	BR 1001 052110 016	21-May-10	<0.12	<0.20	<0.18	<0.17	<0.12	< LOQ	2.2
Lane Snapper	muscle	BR 1001 052210 020	22-May-10	<0.11	<0.18	<0.16	<0.15	<0.11	< LOQ	2.3
Red Snapper	muscle	BR 1001 052110 018	21-May-10	<0.14	<0.23	<0.20	<0.20	<0.14	< LOQ	2.3
Lane Snapper	muscle	BR 1001 052110 018	21-May-10	<0.16	<0.27	<0.24	<0.23	<0.16	< LOQ	1.1
Red Snapper	muscle	BR 1001 052110 019	21-May-10	<0.14	<0.23	<0.21	<0.20	<0.14	< LOQ	2.1
Red Snapper	muscle	BR 1001 052110 018	21-May-10	<0.11	<0.18	<0.16	<0.16	<0.11	< LOQ	2.1
Red Snapper	muscle	BR 1001 052110 018	21-May-10	<0.13	<0.21	<0.19	<0.18	<0.13	< LOQ	2.5

FLA = fluoranthene, CHR = chrysene, BaP = benzo[a]pyrene, BAA = benz[a]anthracene, PYR = pyrene

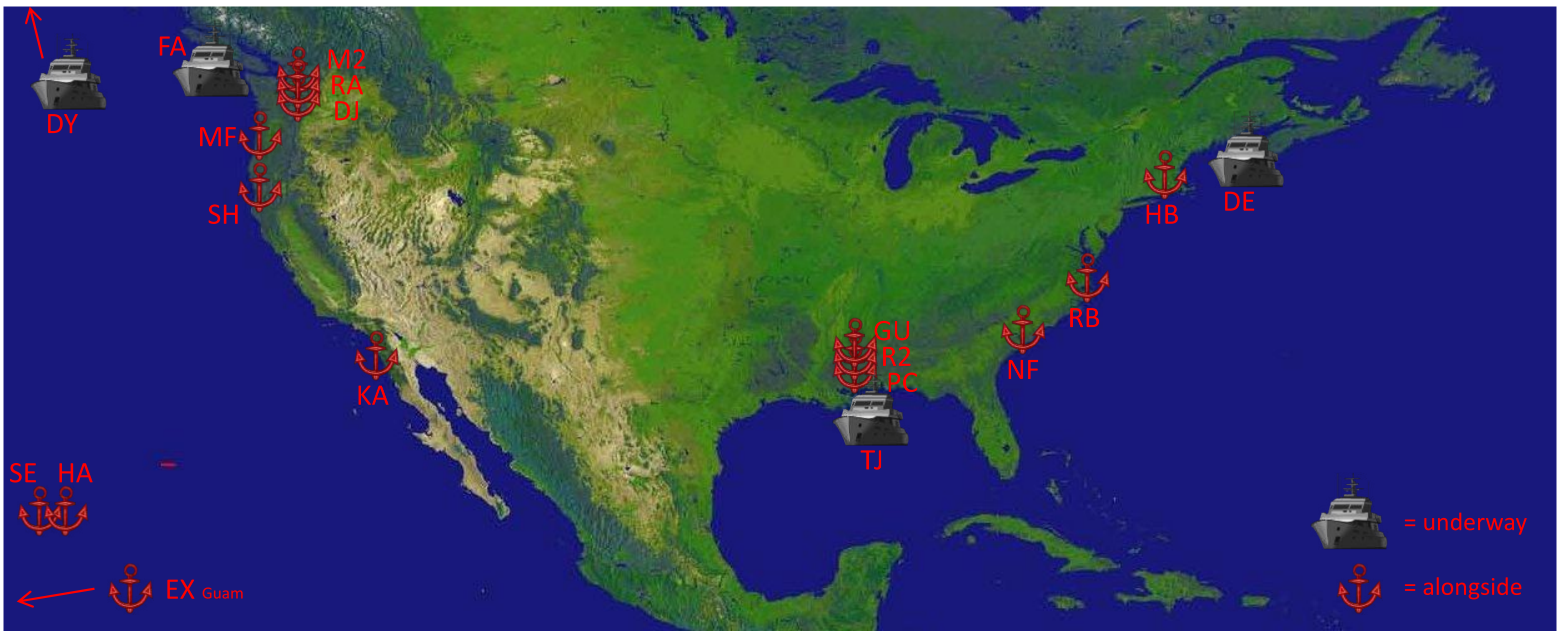
LMWAH = < 3 benzene rings
HMWAH = > 3 benzene rings

NOAA Aircraft Positions
As of 07 JUN 2010



ID	Type	Status Today
N42	P 3	No Flight, MacDill AFB
N43	P 3	CALNEX, Ontario CA repositioning to MacDill AFB
N44	P 3	Maintenance, MacDill AFB
N45	Turbo Cmdr	Maintenance, Indianapolis, IN
N46	Twin Otter	DWH Multi Spectral scanning / oil density and thickness, Mobile, AL
N47	Shrike	Maintenance, MacDill AFB
N48	Twin Otter	CALNEX, Ontario, CA
N49	G IV	Repositioning to Ardmore, OK for TDR work
N51	Shrike	Maintenance, MacDill AFB
N52	Citation	In Disposal Process, MacDill AFB
N56	Twin Otter	Repositioned to Sitka, AK
N57	Twin Otter	DWH Marine survey in Mobile, AL
N68	King Air	DWH Coastal photography / mapping, New Orleans, LA

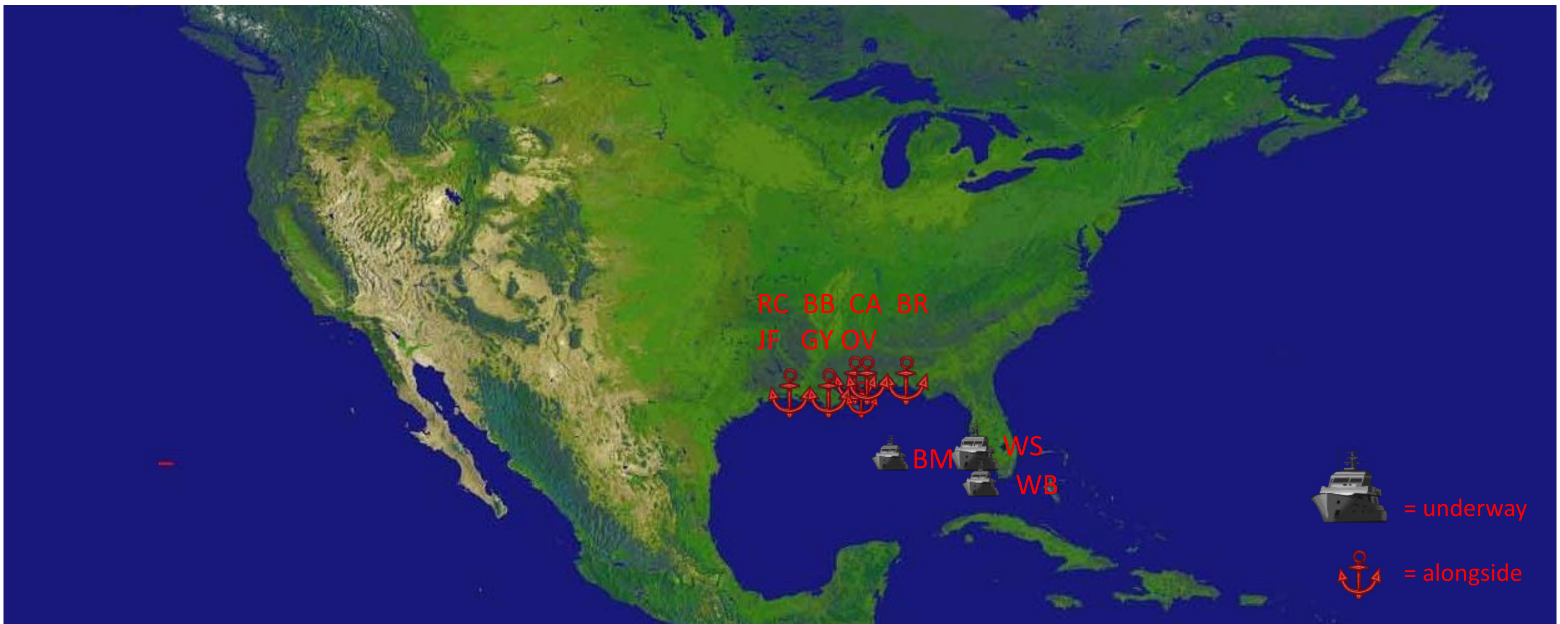
NOAA Ship Positions
As of 07 JUN 2010



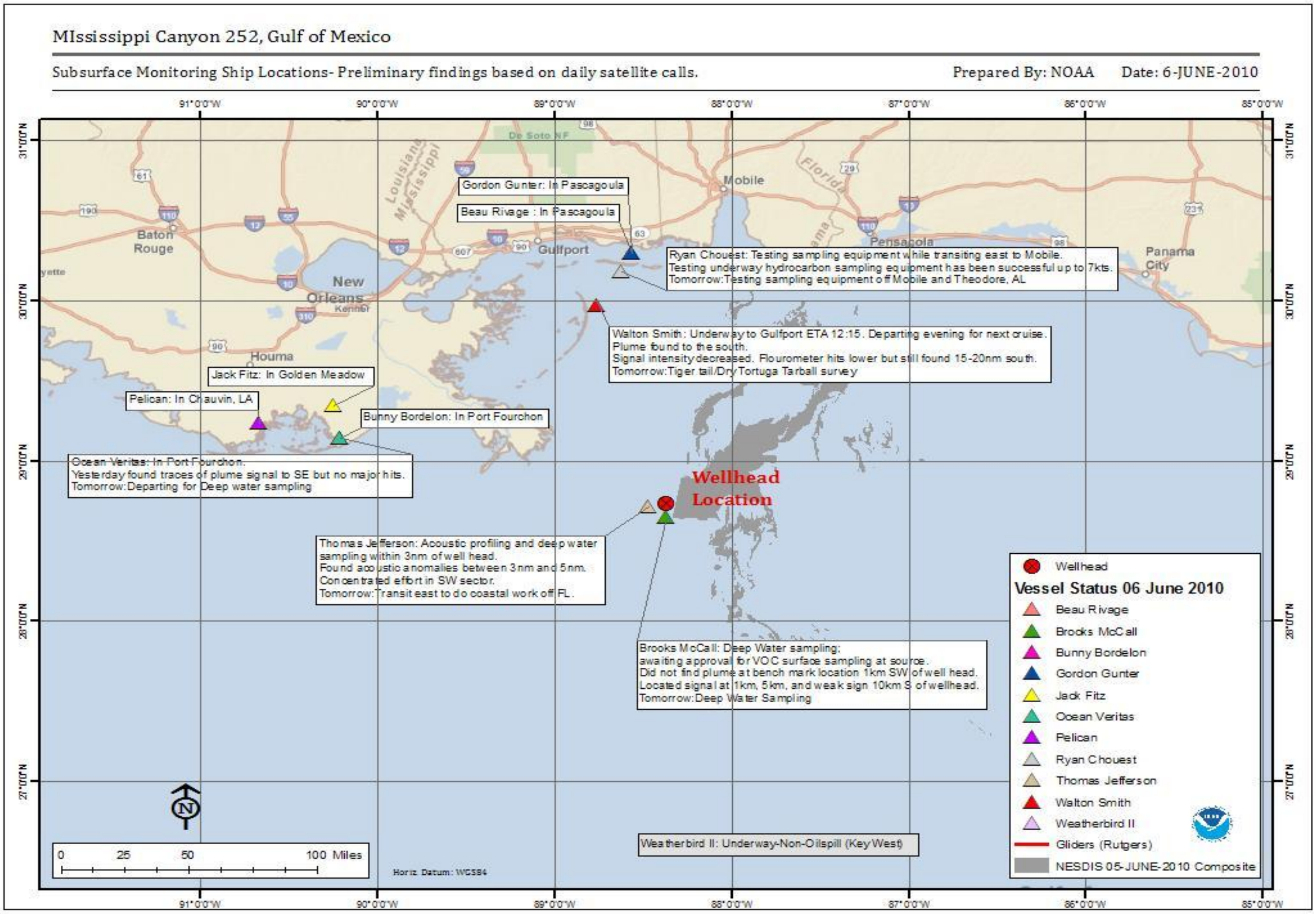
ID	Status Today
FA	Underway on scheduled project. Arrival 6/18 Port Angeles, WA
SH	Alongside Newport, OR. Departure 6/8, transit to Seattle, WA
MF	Alongside Astoria, OR. Departure 6/9 for scheduled project
DY	Underway on scheduled project. Arrival 6/24 Dutch Harbor, AK
HI	Alongside Pearl Harbor, HI. Departure 6/9 for scheduled project
M2	Alongside Seattle, WA. Departure 6/9 for scheduled project
SE	Alongside Pearl Harbor, HI. Departure 7/6 for scheduled project
KA	Alongside San Diego, CA. Departure 7/8 for scheduled project
RA	Alongside Cascade, OR for shipyard repair period
DJ	Alongside Seattle, WA. Decommissioning on week of 7/26
EX	Alongside Guam. Departure 6/8 for scheduled project

ID	Status Today
DE	Underway on scheduled project. Arrival 6/10 Woods Hole, MA
TJ	Underway on DWH “Western Sentry”. Arrival 6/11 Galveston, TX
HB	Alongside Newport, RI. Departure 6/22 for sea trials
NF	Alongside Charleston, SC. Departure 6/18 for scheduled project
RB	Alongside Norfolk, VA. Shipyard repair contract ends 8/13
GU	Alongside Pascagoula, MS. Departure 6/15 for scheduled project
PC	Alongside Pascagoula, MS. Departure 6/14 for scheduled project
R2	Alongside Pascagoula, MS. Departure 6/15 for scheduled project

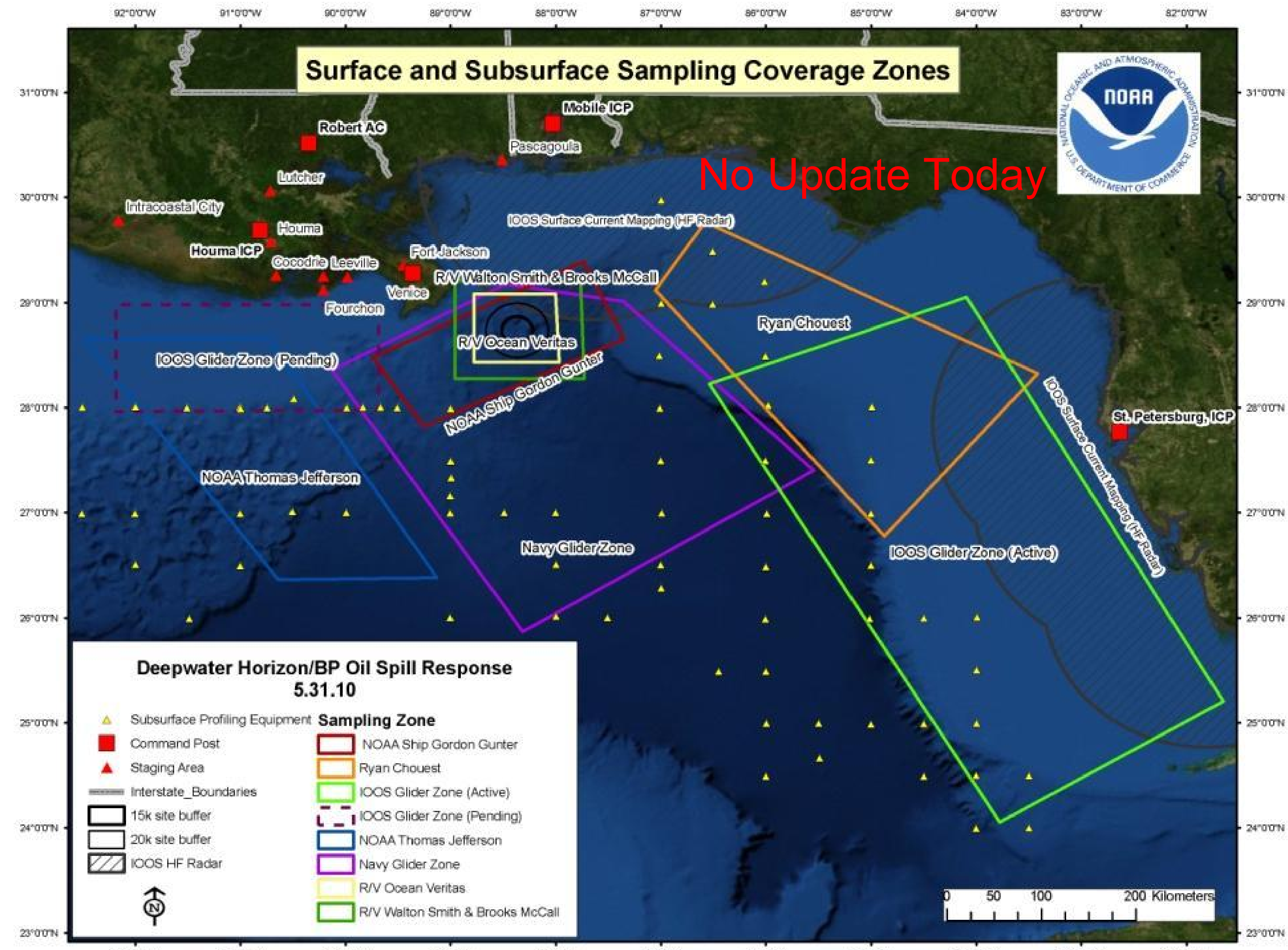
Chartered Vessels and NOAA Small Boats
As of 07 JUN 2010



ID	Type	Status Today
BR	F/V Beau Rivage	Inport Pascagoula, MS
JF	R/V Jack Fitz	Inport Golden Meadow
GY	R/V Gandy	NOAA Small Boat conducting reef fish surveys out of Panama City, FL. ETA Pascagoula 6/7
CA	R/V Caretta	NOAA Small Boat alongside Pascagoula. DWH begin 21 June
WB	R/V Weatherbird II	Underway today from Key West – non oil spill ops
PE	R/V Pelican	Inport Chauvin, LA
BB	M/V Bunny Bordelon	Inport Port Fouchon
OV	R/V Ocean Veritas	Inport Port Fouchon, departing evening6/7 for deep water sampling
RC	R/V Ryan Chouest	Testing Sampling Equipment In Vicinity of Mobile, AL
WS	R/V Walton Smith	En route to Tiger Tail for CTD, Drifter, and XBT work.
BM	R/V Brooks McCall	BP/NOAA Charter. DWH sampling



https://www.st.nmfs.noaa.gov/confluence/display/OOP/Sub+Surface+Monitoring+Ship+Locations

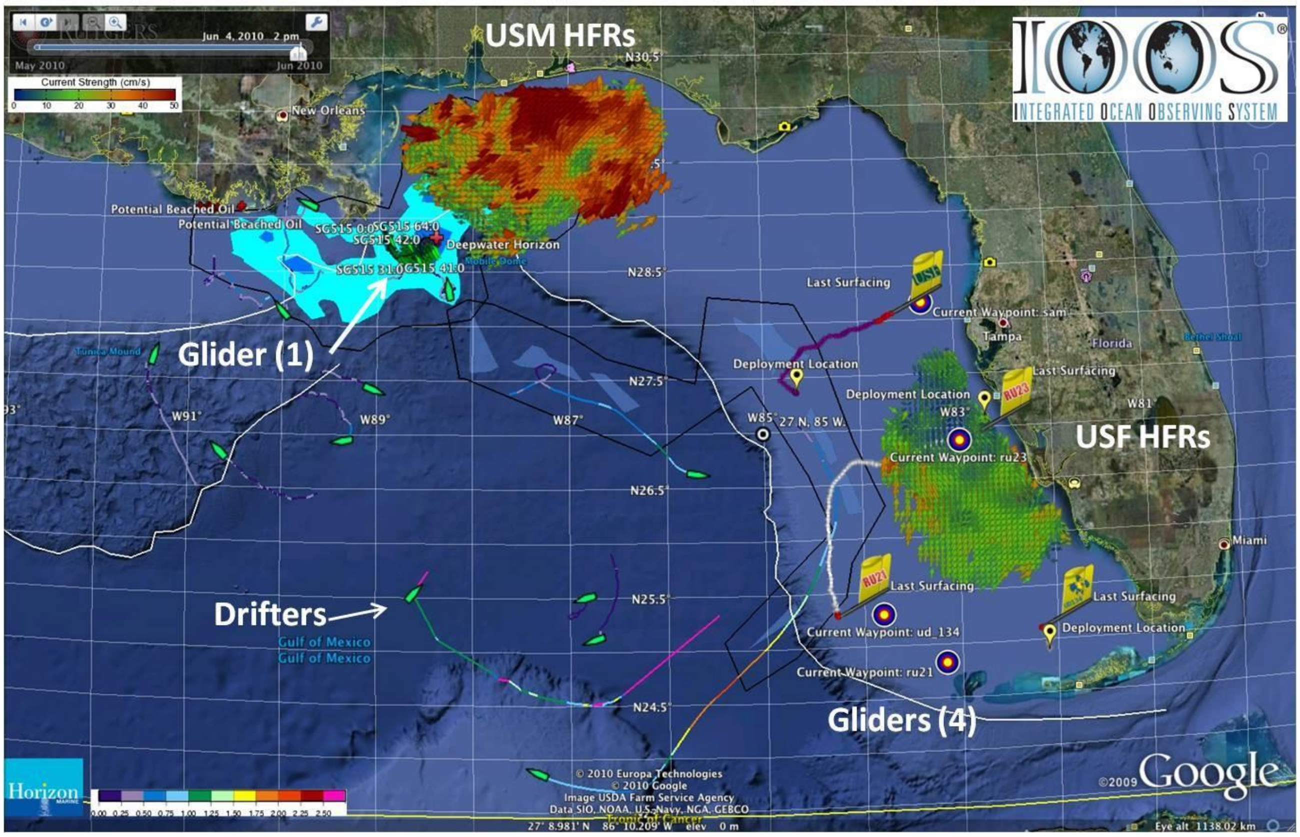


https://www.st.nmfs.noaa.gov/confluence/display/OOP/Maritime+Vessel+Assets

Vessel Assignments for June 7-9, 2010

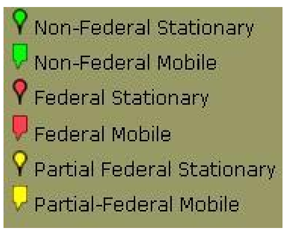
Vessel	Type	Compliment	Latitude	Longitude	Operations for June 7	Operations for June 8	Operations for June 9	Findings
Beau Rivage	109' F/V	6	30 18.0N	88 34.0W	In Pascagoula	Departing for inshore waters off Florida	Coastal sampling	
Brooks McCall	162' ROV Ops	32	28 38.8N	88 22.0W	Waiting for direction for VOC sampling	Arriving in Port Fourchon	In Port Fourchon	Lots of noise, trouble tracking plume. Allowed to approach 500m of wellhead
Bunny Bordelon	150' OSV	16	29 08.6N	90 12.8W	In Port Fourchon	In Port Fourchon	In Port Fourchon	
Gordon Gunter	224' R/V	33	30 18.0N	88 34.0W	In Pascagoula	In Pascagoula	In Pascagoula	
Jack Fitz	165' OSV	26	29 20.9N	90 14.8W	In Golden Meadow	In Golden Meadow	In Golden Meadow	
Navocean Sea Gliders	2 AUV's	N/A			Tracking submersed plume by fluorometry	Tracking submersed plume by fluorometry	Tracking submersed plume by fluorometry	
Ocean Veritas	194' M/V	41	29 08.6N	90 12.8W	Departing in evening for Deep water sampling	Deep water sampling	Deep water sampling	
Pelican	116' R/V	16	29 14.3N	90 40.2W	In Chauvin, LA	In Chauvin, LA	In Chauvin, LA	
Rutgers and USF gliders	3 AUV's	N/A			Monitoring for oil in Florida coastal waters from Tampa to FL Keys	Monitoring for oil in Florida coastal waters from Tampa to FL Keys	Monitoring for oil in Florida coastal waters from Tampa to FL Keys	
Ryan Chouest	215' OSV		30 10.7N	88 37.4W	Getting underway for surface sampling; top 5m	Shallow water sampling for hydrocarbons	Shallow water sampling for hydrocarbons	
Thomas Jefferson	208' R/V	33	28 43.1N	88 28.0W	Transit east to do coastal work off FL.	Working west toward Port Fourchon and will need VOOP resupply	Coastal sampling	Hotspots are less active; seeing high phosphorescense and low disolved O2
Walton Smith	96' R/V	19	29 58.4N	88 45.6W	En route to Tiger Tail. CTD, Drifter and XTB's	Tiger tail/Dry Tortuga Tarball survey	Tiger tail/Dry Tortuga Tarball survey	
Weatherbird II	115' R/V	20	24 43.6N	83 17.3W	Underway Non Oilspill	Underway Non Oilspill	Underway Non Oilspill	

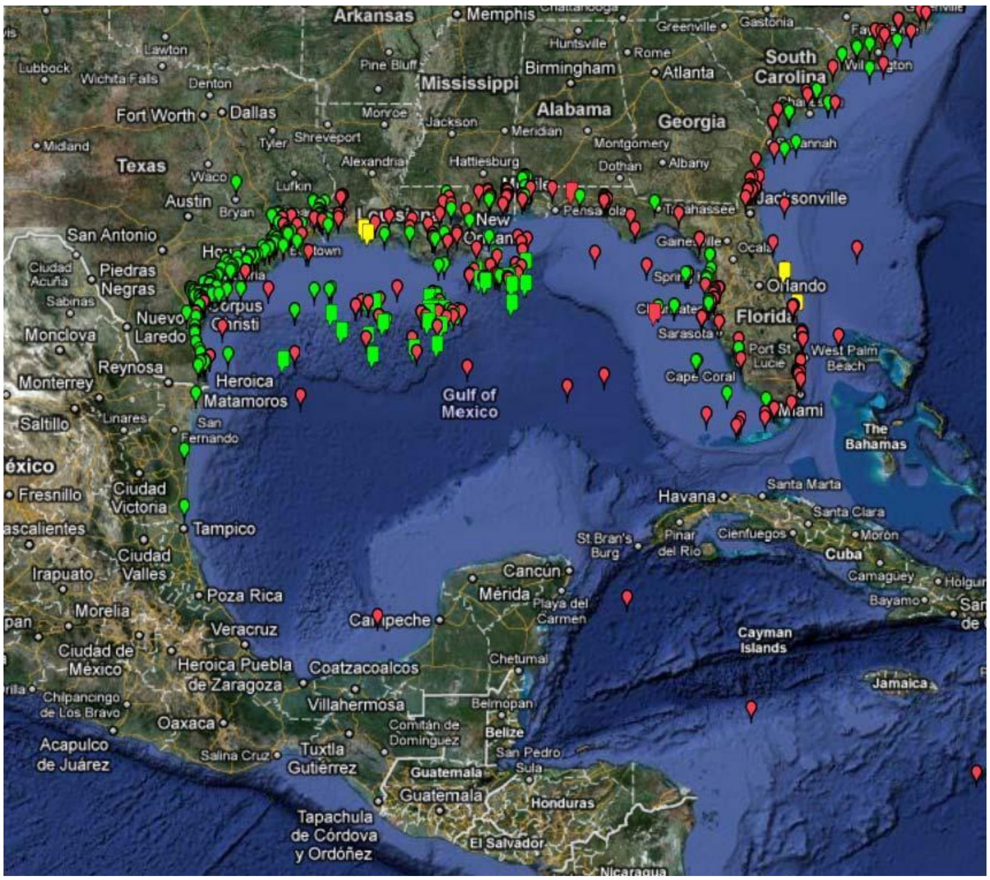
US IOOS® Assets deployed 4 June



Gliders (5) : IOOS Partners: MACOORA (Rutgers, U Del); SECOORA (USF); GCOOS (USM)
High Frequency Radars (6) – Surface currents : IOOS Partners GCOOS (USM); SECOORA (USF)
Drifters (10) : Horizon Marine
Data: http://rucool.marine.rutgers.edu/deepwater/

All Observing Assets in GOM (Fed/Non-Fed)





Includes: Private, Academic, State, NOAA/NDBC, NOAA/CO-OPS, NOAA/IOOS*

* Includes IOOS Regional Associations

Update through June 6 2010 (as of 1800)

Marine Mammal and Sea Turtle Health and Response

Noteworthy Developments During this Reporting Period:

- Increase of 6 turtle strandings, all dead (1 in FL, 1 in AL, 1 in MS, 3 in LA)
- Capture of 5 heavily oiled turtles from the directed offshore search effort (4 live and 1 dead)
- A third Kemp's ridley recovered June 1 from the offshore search/rescue operation died today at Audubon Aquarium
- Increase of 2 dolphin strandings (2 dead in LA, 1 of which was externally oiled)
- The current designated spill area encompasses the coastline from the Texas/Louisiana border to Apalachicola (Franklin County), Florida. All stranded animals within this geographic range are being examined following the oil spill response protocols.

Sea Turtles:

300 total sea turtles verified to date within the "designated spill area" (increase of 11 from June 5)

- 270 stranded* (increase of 6 from June 5)
  - 248 of the stranded were found dead (increase of 6 from June 5)
  - 22 of the stranded were found alive (no change from June 5)
    - 3 recovered alive but died in rehab (no change from June 5)
    - 3 turtle released alive (no change from June 5)
    - 16 live turtles in rehabilitation (no change from June 5)
- 30 turtles collected during directed turtle sampling efforts (increase of 5 from June 5)
  - 25 live turtles in rehabilitation (4 new, 1 died, net increase of 3 from June 5)
  - 2 turtles collected dead (increase of 1 from June 5)
  - 3 turtles died in rehabilitation (increase of 1 from June 5)

* For this event, a true stranding is defined as a turtle that washes ashore dead or debilitated or is found floating dead or debilitated in the course of non-directed turtle surveys. Turtles observed and/or captured during directed sampling efforts are not categorized as strandings.

Turtle Necropsy Status (of the 248 dead stranded, 2 dead directed capture, and 6 that died in rehab):

- 7 assessed and unable to perform necropsies (i.e. advance decomposition) (no change from June 5)
- 17 partial necropsies (e.g. due to scavenging or autolysis) (no change from June 5)
- 53 full necropsies performed (increase of 3 from June 5)
- 46 carcasses not collected due to decomposition state or unable to recover but marked and/or buried (no change from June 5)
- 133 carcasses to be necropsied, if decomposition stage warrants (increase of 5 from June 5)

Information on Signs of Sea Turtle Oiling:

- To date, visible evidence of oil has been documented externally on 1 dead stranded sea turtle and 4 live stranded turtles (2 of which were caught in skimming operations).
- To date, visible evidence of oil has been documented externally on 28 live sea turtles and

2 dead sea turtle captured during directed turtle surveys.

Historical Sea Turtle Strandings:

- The total number of sea turtle strandings that we have documented from the Louisiana/Texas border through the Florida panhandle from April 30 through June 6 is 270.
- This is much higher than the number of turtle strandings that have been documented in recent years in Louisiana, Mississippi, and Alabama during this approximate time frame (combined range of 4-30 for LA, MS, and AL)
    - Overall Northern Gulf range for recent years has been 18-46.
    - From 2005 – 2009 the number of turtle strandings for the month of May has ranged from 1 to 15 in Louisiana
    - From 2005 – 2009 0 to 13 in Mississippi
    - From 2005 – 2009 1 to 15 in Alabama
    - In the Florida panhandle, from 2005 - 2009, the number of strandings in May has ranged from 14 to 29
- There has been an increase in awareness and human presence in the northern Gulf of Mexico, which likely has resulted in some of the increased documentation of stranded turtles; however, we do not believe this factor fully explains the increase.

Marine Mammals:

- 35 dolphins have been verified to date within the "designated spill area" (increase of 2 from June 5).
    - 33 were dead stranded* dolphins (increase of 2 from June 5)
    - 2 were live stranded dolphins, one of which that died shortly after stranding, one that was euthanized upon stranding (no change from June 5)

* Under the Marine Mammal Protection Act Section 409.3, a marine mammal stranding is defined as an event in the wild where:

- A marine mammal is dead and is on the beach or shore of the United States or in waters under the jurisdiction of the United States (including any navigable waters); OR
- A marine mammal is alive and is on a beach or shore of the United States and unable to return to the water, on a beach or shore of the United States and, although able to return to the water, is an apparent need of medical attention or in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance.

Update through June 6 2010 (as of 1800)

Dolphin Necropsy Status (of the 33 dead stranded and 2 live stranded that died or were euthanized):

- 12 assessed and unable to perform necropsies (e.g. advanced decomposition) (no change from June 5)
- 7 partial necropsies performed (e.g. due to scavenging or autolysis) (no change from June 5)
- 6 full necropsies performed (increase of 1 from June 5)
- 8 verified strandings but animals not collected due to stage of decomposition or unable to recover (increase of 1 from June 5)
- 2 carcasses to be necropsied, if decomposition stage warrants (no net change: increase of 1, decrease of 1 from June 5)

Information on Signs of Dolphin Oiling:

- Two of the verified dolphins have evidence of external oil on the tongue and/or body and therefore were classified as oiled. However, we are unable at this time to determine whether the animal was externally oiled pre- or post-mortem.

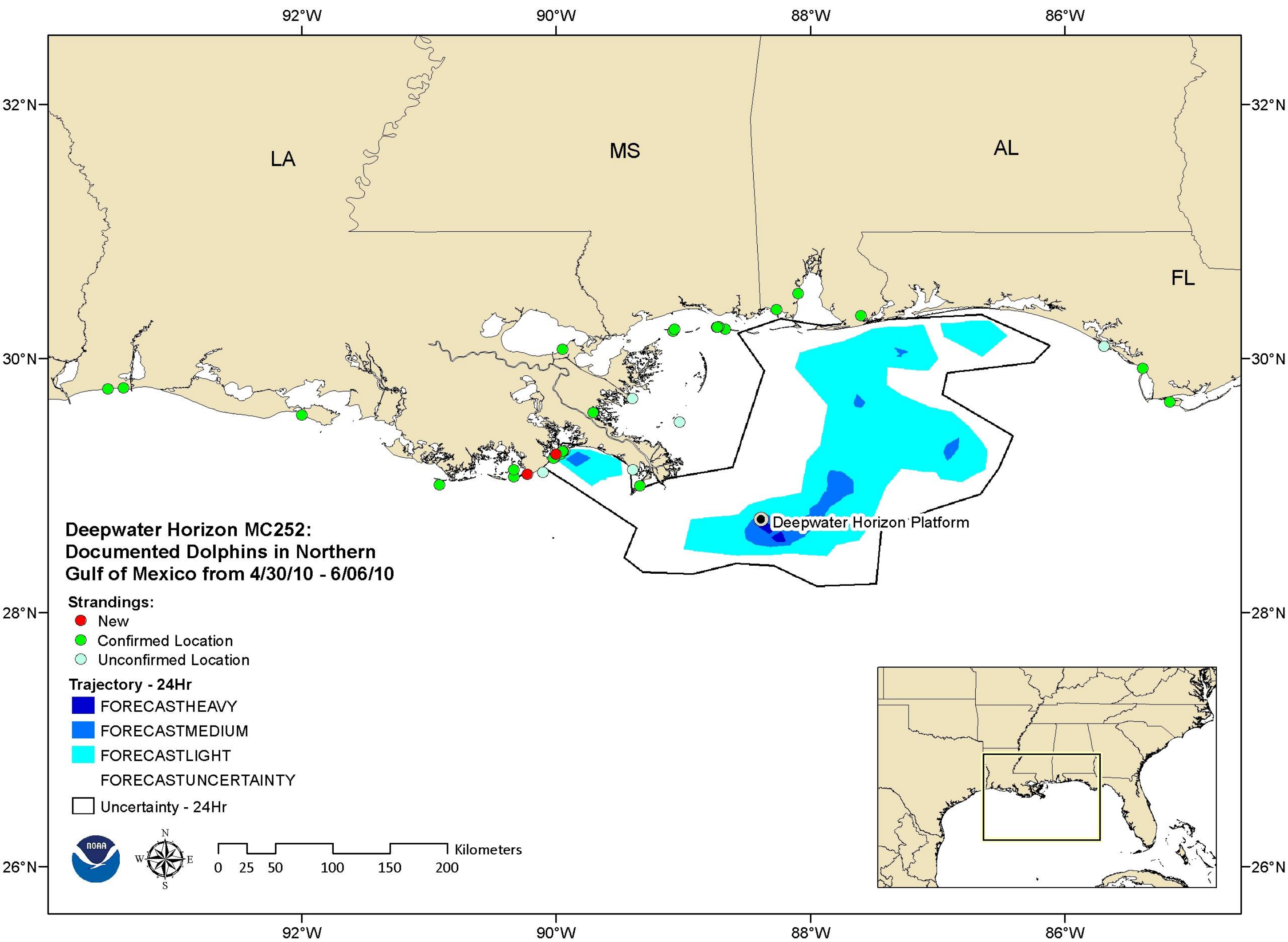
Historical Dolphin Strandings

- Since April 30, the observed dolphin stranding rate is higher than the historical averages that have been documented in recent years (2003-2007) in Louisiana, Mississippi, and Alabama. In part, this may be a reflection of increased detection and reporting and the lingering effects of an earlier observed spike in strandings for the winter of 2010.
- For the entire Northern Gulf of Mexico, the combined observed range is 0-6 for the years 2003 to 2007 in LA, MS, AL, and FL (panhandle only). The breakdown by state for the range of animals historically stranding in the month of June (2003-2007) is as follows:
  - Louisiana: 0-5 stranded dolphins
  - Mississippi: 0-1 stranded dolphins
  - Alabama : 0-1 stranded dolphins
  - Florida panhandle: 0-4 stranded dolphins

<u>Summary of Action Plan Items:</u>

- The directed turtle survey operating under Unified Command was on the water today and captured 4 live and 1 dead oiled turtles. Operations are planned again for June 7.
- Press interest remains high on sea turtle activities. UC Davis and Audubon, with consultation with NOAA, allowed CBS National News to film at the rehabilitation facility as well as when the directed turtle captures arrived at the dock this evening. NMFS Public Affairs is also working closely with UC Davis and Audubon, and in coordination with the JIC, to organize a press event (to be announced by the Unified Command) this coming week around the turtles in rehabilitation at Audubon. Film taken by CBS at dockside will be available to these media outlets as pooled footage.
- Discussions are underway to relocate the turtles currently in rehabilitation at Audubon and IMMS to secondary facilities for longer-term rehab to ensure open space and sufficient staff at the primary de-oiling facilities to handle expected additional turtles in

the coming week.


92°W
90°W
88°W
86°W
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28°N
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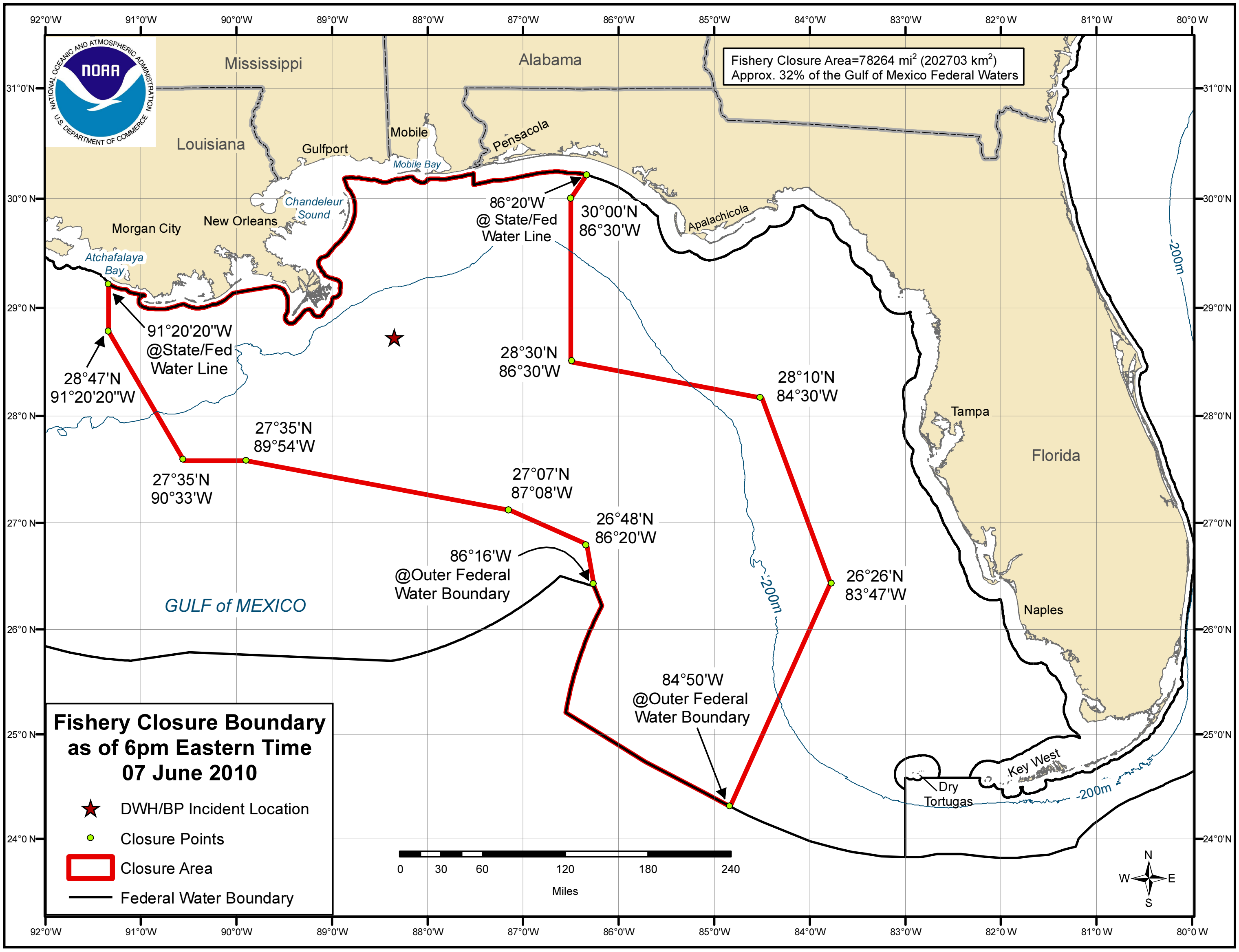
LA
MS
AL
FL
Deepwater Horizon Platform
Deepwater Horizon MC252:
Documented Dolphins in Northern
Gulf of Mexico from 4/30/10 - 6/06/10
Strandings:
New
Confirmed Location
Unconfirmed Location
Trajectory - 24Hr
FORECASTHEAVY
FORECASTMEDIUM
FORECASTLIGHT
FORECASTUNCERTAINTY
Uncertainty - 24Hr
Kilometers
0 25 50 100 150 200



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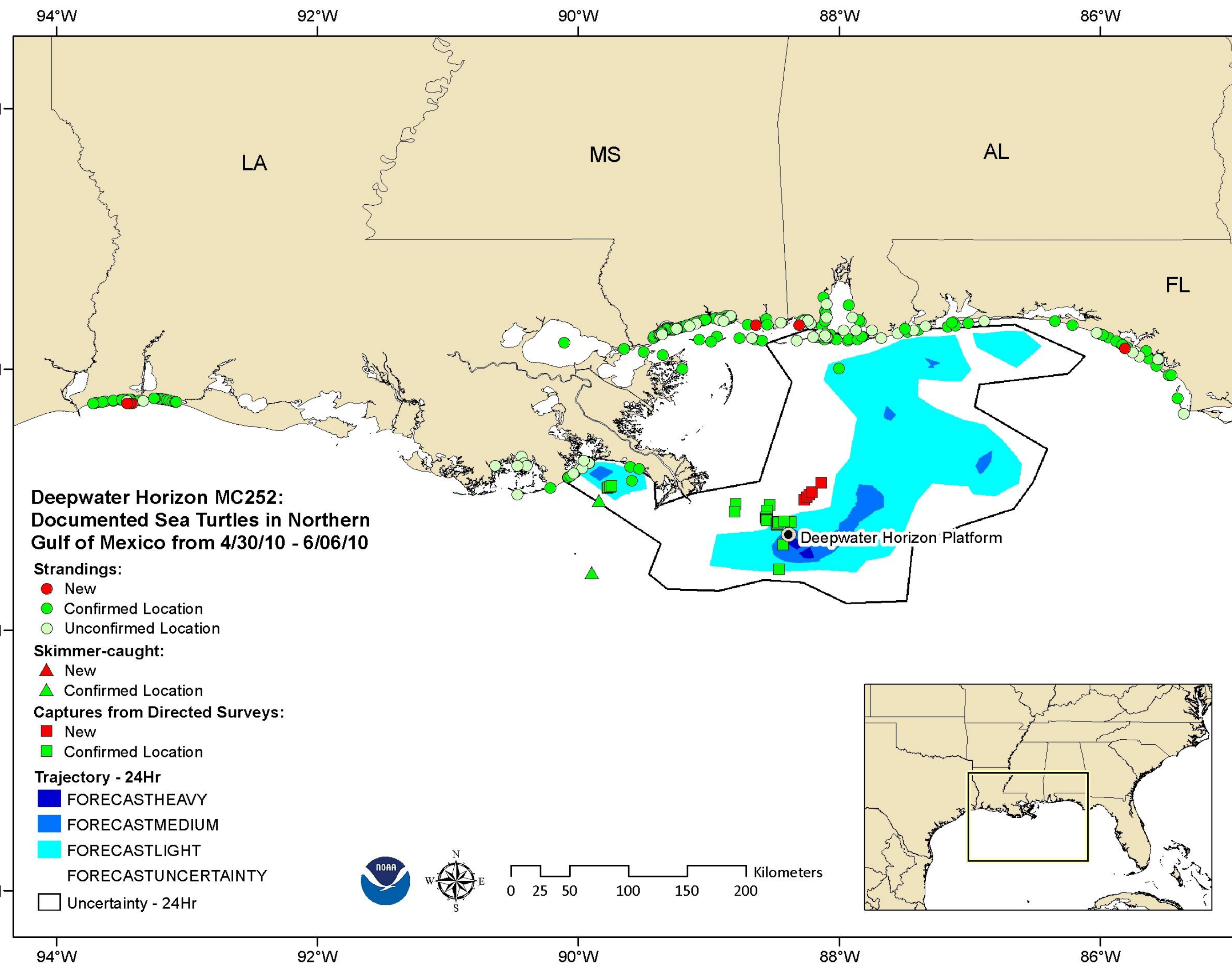

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Seafood Safety Daily Report
Reported from Seafood inspection Program, National Seafood Inspection Laboratory and Northwest Fishery Science Center
Monday, June 7, 2010

Seafood Inspection Program:

- Steven Wilson finalized the seafood surveillance plan and sent it out to the seafood safety team for review. Comments are expected by COB today.
- SIP personnel will hold their next State sensory training tomorrow in Pascagoula, MS. After that a small crew of four will be available for surveillance activities.

Northwest Fishery Science Center (NWFSC):

- Three NWFSC staff left for Pascagoula, MS on June 6 to work with NSIL staff to process fish and shrimp for chemical analyses.
- NWFSC is continuing chemical analysis of oyster, shrimp, snapper and croaker tissues.
- NWFSC outlined the plan for development of a relational database to report data from chemical and sensory analysis of fish and shellfish. Data will need to be collected from SEFSC, SIP, NSIL and NWFSC to populate the database.

National Seafood Inspection Laboratory

- Processing baseline samples from SEFSC contracted vessel Simple Man from a couple of weeks ago.
- Hosting SIP Sensory Analysts and FDA representatives.
- Preparing to host approx. 20 State personnel in DWH taint sensory training starting tomorrow.
- Working out logistical problems with SEFSC on obtaining GIS mappings of sampling locations vs. cruise tracks in order to facilitate combining seafood species samples from nearby sites into amounts needed to perform sensory analysis on.
- Working on scheduling of SEFSC Fisheries Scientist availability to taxonomically id previously collected but unidentified DWH seafood specimens.
- Friday afternoon (6/4/10) provided demonstration of DWH seafood sample receipt and processing for Dr. Lubchenco and staff.
- Friday afternoon (6/4/10) provided demonstration of DWH taint sensory analysis protocols and procedures for Dr. Lubchenco and staff.

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Received(Date): Wed, 09 Jun 2010 10:29:14 +0100
From: "St John, Karen" <karen.stjohn@bp.com>
Subject: BP Gulf of Mexico Updte: June 8 2010

Gulf of Mexico Oil Spill Response Update

06/08/2010 – 8:00pm EDT

BP is working as part of the Unified Command to accomplish three main objectives in the Gulf of Mexico:

1. On the Sea Floor to stop the flow of oil through various strategies;

2. On the Surface to minimize impacts of the spill; and

3. Onshore to protect the shoreline and inform the public.

Highlights

- 14,842 barrels of oil captured by the Lower Marine Riser Package Cap in the past 24 hours.
- 17 staging areas established for shoreline protection.
- 30 claims office now open.
- BP to fund wildlife trust fund with proceeds from captured oil.
- 12 controlled burns conducted since noon Monday.
- 27,665 safety and hazardous material handling training modules completed.
- Skimming continues--15.8 million gallons of oily water collected and treated.

Offshore – Sea Floor

BP's priority is to reduce and stop the flow of oil subsea and minimize environmental impacts through multiple strategies:

ContainmentRecovery – Lower Marine Riser Package (LMRP) Cap

Operations Summary: 14,842 barrels of oil were captured through the LMRP cap during the past 24-hour period. Oil and natural gas are being carried to the surface through a riser pipe and oil is being stored on the *Discoverer Enterprise.* Efforts to optimize flow continue and one valve has been closed.

Two additional strategies are planned in conjunction with the LMRP cap and progress on each continues.

- Q4000 Direct Connect: the hoses and manifold that were deployed for the "top kill" operation will take oil directly from the blowout preventer through a separate riser to the Q4000 vessel on the surface. This system, expected to be available for deployment in mid-June, is intended to increase the overall efficiency of the containment operation by increasing the amount of oil and gas flow that can be captured from the well.

- Long-term Containment Option: this operation will take oil from the LMRP via a manifold to a new free-standing riser that will end approximately 300 feet below sea level. A flexible hose will attach it to a containment vessel at surface. This option is designed to more effectively disconnect and reconnect the riser to provide the greatest flexibility for operation during a hurricane. Implementation is expected in late June or early July.

Dispersant injection on the sea floor – dispersant use at the subsea leak source continues, with approximately 21,000 gallons applied since Sunday. EPA is allowing subsea application of the currently-used dispersant to continue.

Drilling Relief Wells

They are situated approximately one-half mile from the Macondo well and will attempt to intercept the existing wellbore at approximately 18,000 feet below sea level. Once intercepted, the Macondo well can be killed via a "bottom kill" by pumping heavy mud and cement down the hole. It is estimated the total drilling process for each well will take at least 90 days from the start date.

- The first relief well (work being performed by the *Development Driller III*) is at approximately 14,000 feet below sea level. Drilling began on May 2.

- The second relief well (work being performed by *Development Driller II*) is at approximately 8,600 feet below sea level and the blowout preventer is being tested. Drilling began on May 16.

Offshore – Surface Spill Response

Cleanup Vessels – 3,100 vessels are now deployed, including tugs, barges and recovery boats.

Skimming Vessels – 111 of the cleanup boats are skimmers, designed to separate oil from water.

Approximately 15.8 million gallons of oil-water mix have been recovered and treated.

Surface Dispersant – An additional 4,000 gallons of dispersant was applied on the surface yesterday. 246,000 gallons of dispersant remain available for surface application.

In-Situ Burning – The Unified Command has conducted an additional 12 in-situ burns since noon on Monday. It is estimated that 85,400 barrels of oil have been burned.

Spill Response Technology Ideas / Offers of Services or Products

BP

ξ BP has received more than 20,000 ideas on how to stop the flow of oil or contain the oil spill since the Gulf of Mexico incident began. To submit alternative response technology, services or products, call (281) 366-5511. Each caller to the Houston suggestion line will have their details entered into the Horizon Call Center database. The database will then send the caller a simple form, termed either the Alternative Response Technologies form, or the Products and Services Form, for them to set out the details of their idea. The forms are available online at: www.horizonedocs.com. After the caller completes and submits the form, it is sent for review by a team of 30 technical and operational personnel who will review its technical feasibility and application. Given the quantity of the proposals and the detail in which the team investigates each idea, the technical review can take some time.

US Government

ξ On June 4, the newly formed Interagency Alternative Technology Assessment Program workgroup was announced by the National Incident Commander for the BP Deepwater Horizon oil spill, in an effort to collect and review oil spill response solutions from scientists and vendors. The Coast Guard's Research and Development Center, in collaboration with interagency partners, issued a Broad Agency Announcement found at https://www.fbo.gov/index?s=opportunity&mode=form&id=6b61794cf96642c8b03fcf9e0c3083eb&tab=core&_cview=1 calling for the submission of white papers that cover: oil sensing improvements to response and detection; oil wellhead control and submerged oil response; traditional oil spill response technologies; alternative oil spill response technologies; and oil spill damage assessment and restoration.

The IATAP and the RDC will screen and triage submissions based on technical feasibility efficacy and deployability. This will be a federal process to ensure a fair, systematic, responsive and accountable review of alternative response technologies by interagency experts. The IATAP and RDC initial screening will result in one of three determinations: the white paper has a potential for immediate benefit to the oil spill response effort; the white paper submission needs more detailed investigation or evaluation by the appropriate government agency; or the white paper submission does not support this incident.

Onshore - Shoreline Protection and Community Outreach

Wildlife Fund Established – BP announced today it will establish a new wildlife fund to create, restore, improve and protect wildlife habitat along the coastline of Louisiana, Mississippi, Alabama, and Florida. The creation of this fund is over and above BP's obligations under the Oil Pollution Act of 1990.BP will direct all net revenue from the saleable oil recovered from the MC252 into the fund. Net revenue is BP's share of the proceeds after federal royalties, taxes, and other interest owners have been paid.

Wildlife Impacts: on Monday there were 107.

Louisiana Barrier Island Project Funding – BP has deposited $360 million into escrow to fund construction of six sections of the Louisiana Barrier Islands Proposal. Funding for the first section has been released.

Boom Report – Across Louisiana, Mississippi, Alabama and Florida 2.19 million feet of containment boom have been deployed (with an additional 702,000 feet being staged). 2.46 million feet of sorbent boom have been deployed (with an additional 2.52 million feet available or being staged.)

Claims

Approximately 18,400 checks have been written for over $48 million and over 38,000 claims have been submitted. 500 claims adjusters are operating across the Gulf Coast and 125 operators are taking calls.

ξ BP announced on Sunday that it will pay a second round of advance payments to existing claimants during the month of June. This is to compensate businesses and individuals for loss of income and loss of wages caused by the spill.

ξ BP has 30 claims offices open to help claimants through the process—see locations below. Vietnamese and Spanish translators are in some offices. *Note:* No person asserting a claim or receiving payment for interim benefits will be asked or required to sign a release or waive any rights to assert additional claims, to file an individual legal action, or to participate in other legal actions associated with the Deepwater Horizon incident.

ξ The contact number for claims is (800) 440-0858. In person claims can be filed at office locations listed below. Claims can also be filed online at: http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138

Independent Claims Mediator Established – BP is appointing an Independent Mediator to ensure a fair claims process for people affected by the spill. BP will pay legitimate, substantiated claims for loss and damage caused by the spill, and is committed to paying claims promptly. In those cases where a claimant disagrees with the outcome of the process, the mediator will provide a way for them to get an independent review.

Total Cost – The cost of the response to date has exceeded $1.25 billion, including the cost of the spill response, containment, relief well drilling, grants to states, claims paid, and federal costs submitted so far.

$500 Million for 10-year Research Program to Study Spill Impacts – BP is contributing $500 million over 10 years to fund an open research program studying the impact of the Deepwater Horizon incident, and its associated response, on the marine and shoreline environment of the Gulf of Mexico.

BP Provides $70 million in Tourism Grants to States – BP has made $70 million available to Louisiana, Mississippi, Alabama and Florida to promote tourism.

Volunteers and Training – 19,822 volunteers were signed up, trained, and working on Monday. Volunteers are being trained in five different modules that range from safety for beach clean-up, to wildlife monitoring, handling of hazardous materials and vessel operation for laying boom. As of today, more than 29,000 training courses have been completed by those working on the incident. Information about training can be found on the incident website at www.deepwaterhorizonresponse.com under "volunteers."

State Specific Websites – These websites are designed to provide state-specific oil spill information to residents of communities affected by the Deepwater Horizon oil spill

ξ Alabama: www.alabamagulfresponse.com

ξ Florida: www.floridagulfresponse.com

ξ Louisiana: www.louisianagulfresponse.com

ξ Mississippi: www.mississippigulfresponse.com

Onshore – Regional Operations and Outreach

Staging Areas – 17 staging areas are being utilized for rapid deployment to protect sensitive shorelines.

- Dauphin Island, AL
- Orange Beach, AL
- Theodore, AL
- Panama City, FL
- Pensacola, FL
- Port St. Joe, FL
- St. Marks, FL
- Amelia, LA
- Cocodrie, LA
- Grand Isle, LA
- Shell Beach, LA
- Slidell, LA
- St. Mary, LA
- Venice, LA
- Biloxi, MS
- Pascagoula, MS
- Pass Christian, MS

Claims Offices – 30 Claims offices have been established by BP across the Gulf Coast to provide locations where people can go to file or discuss claims. There are more than 500 claims adjusters staffing the offices.

Louisiana (12 locations) –

- Belle Chasse/Gretna

2766 Belle Chasse Hwy

Belle Chasse, LA 70037

ξ Chauvin (Terrebonne Parish)

5703 Hwy 56

Chauvin, LA 70344

ξ Cut Off (Lafourche Parish)

Tarpon Heights Shopping Center

Unit 2

16263 E. Main Street

Cut Off, LA 70345

ξ Grand Isle (Jefferson Parish)

3811 LA 1 (Community Center)

Grand Isle, LA 70358

ξ Houma (Terrebonne Parish)

Plaza Caillou Shopping Center

814 Grand Caillou Road

Suite 2 & 3

Houma, LA 70363

ξ Lafitte (Jefferson Parish)

2654 Jean Lafitte Blvd

Town Hall

Lafitte, LA 70067

- Morgan City (St. Mary Parish)

931 US Hwy 90 East

Bayou Vista, LA 70380

- New Orleans East (Orleans Parish)

4375 Michoud Blvd

New Orleans, LA 70461

- New Iberia (Iberia Parish)

956 S. Lewis Street

New Iberia, LA 70560

- Slidell (St. Tammany Parish)

2040 Gause Blvd., Suite 10

Slidell, LA 70461

- St. Bernard (St. Bernard Parish)

1345 Bayou Rd

Saint Bernard, LA 70085

- Venice/Boothville (Plaquemines Parish)

41093 Hwy LA 23

Boothville, LA 70038

Mississippi (3 locations) –

- Bay St. Louis (Hancock County)

1171 Highway 90

Bay St. Louis, MS 39520

- Biloxi

920 Cedar Lake Rd, Suite K

Biloxi, MS 39532

- Pascagoula

5912 Old Mobile Hwy

Suite 3

Pascagoula, MS 39581

Alabama (5 locations) –

- Bayou LaBatre

13290 N. Wintzell Avenue

Bayou LaBatre, AL 36509

- Dauphin Island (Mobile County)

1008 Alabama Avenue

Dauphin Island, AL 36528

- Foley (Orange Beach/Gulf Shores/Bon Secour)

1506 North McKenzie Street (HWY 59)

Suite 104

Foley, AL 36535

ξ Gulf Shores / Orange Beach (Baldwin County)

24039 Perdido Beach Blvd

Suite 1

Orange Beach, AL 36561

ξ Mobile (Mobile County)

325 East I-65 Service Rd S

Suite 1

Mobile, AL 36606

Florida (10 locations) –

ξ Apalachicola (Franklin County)

194 14th Street

Suite 105

Apalachicola, FL 32320

ξ Crawfordville (Wakulla County)

3010 Crawfordville Hwy

Suite A&B

Crawfordville, FL 32327

ξ Ft. Walton Beach (Okaloosa County)

348 SW Miracle Strip Pkwy

Suite 13

Fort Walton Beach, FL 32548

- Gulf Breeze (Santa Rosa County)

5668 Gulf Breeze Pkwy

Unit B-9

Gulf Breeze, FL 32563

- Marathon (Monroe County)

7885 Overseas Hwy

Marathon, FL 33050

- Panama City (Bay County)

7938 Front Beach Road

Panama City Beach, FL 32408

- Pensacola (Escambia County)

3960 Navy Boulevard

Suite 16-17

Pensacola, FL 32507

- Port St. Joe (Gulf County)

106 Trade Circle

Suite A

Port St. Joe, FL 32456

ξ Key West (Monroe County)

3706 N. Roosevelt Blvd

Suite H

Key West, FL 33040

ξ Santa Rosa Beach (Walton County)

5008 US Hwy 98W

Unit 6&7

Santa Rosa Beach, FL 32459

Contact Information	
Environment / Community Hotline – to report oil on the beach or shoreline or other environment or community impacts and access the Rapid Response Team	(866) 448-5816
Wildlife – to report and access care for impacted, i.e. oil wildlife	(866) 557-1401
Volunteers – to request volunteer information	(866) 448-5816
Services – to register as consultant, contractor, vendor, or submit information on alternative response technology, services, products or suggestions	(281) 366-5511
Vessels of Opportunity – to report and register boats available to assist with response	(281) 366-5511
Training – for questions about training requirements, times and locations, and to sign up\	(866) 905-4492 or (866) 647-2338
Ideas to Submit – File online at http://www.horizonedocs.com/index.html	
Investor Relations	(281) 366-3123
Claims – by phone	(800) 440-0858
Claims – http://www.bp.com/iframe.do?categoryId=9033722&contentId=7062138	
Joint Information Center – Robert, LA – Media and information center	(985) 902-5231 or (985) 902-5240
Joint Information Center – Mobile, AL – Media and information center	(251) 445-8965
Transocean Hotline	(832) 587-8554
MI Swaco Hotline	(888) 318-6765
BP Family – and third-party contractor hotline	(281) 366-5578
Twitter: Oil_Spill_2010	
Facebook: Deepwater Horizon Response	
Joint Incident Command website: www.deepwaterhorizonresponse.com	

Press Release June 8, 2010

BP TO DONATE NET REVENUE FROM MC252 WELL LEAK TO PROTECT AND REHABILITATE WILDLIFE IN GULF STATES

As part of its commitment to restore the environment and habitats in the Gulf Coast region, BP today announced that it will donate the net revenue from oil recovered from the MC252 spill to create a new wildlife fund to create, restore, improve and protect wildlife habitat along the coastline of Louisiana, Mississippi, Alabama, and Florida. The creation of this fund is over and above BP's obligations under the Oil Pollution Act of 1990.

BP's net revenue from the sale of oil recovered from skimming operations and the well containment systems will be deposited into this newly-created fund. At this point, BP cannot predict the total of amount of net revenue that will be deposited into the wildlife fund. The amount of funding will be contingent upon the amount of oil collected during operations and the price at which the oil is sold. BP will provide regular updates on the amount of proceeds being deposited into the fund.

"We've already launched the largest environmental response in history, and BP is committed to protecting the ecosystems and wildlife on the Gulf Coast. Proceeds from the sale of oil recovered from the MC252 well will be used to further this commitment," said Tony Hayward, BP's chief executive officer. "We believe these funds will have a significant positive impact on the environment in this region."

The creation of wildlife fund is the latest example of BP's commitment to help the Gulf Coast states and their residents. On May 24, 2010, BP announced a commitment of up to $500 million for an open research program studying the impact of the Deepwater Horizon incident, and its associated response, on the marine and shoreline environment of the Gulf of Mexico.

BP Press Office London: +44 20 7496 4076

BP Press office, US: +1 281 366 0265

Unified Command Joint Information Center: +1 985-902-5231

www.deepwaterhorizonresponse.com

www.bp.com/gulfofmexicoresponse

Karen St John

BP America

Sr. Director, Regulatory Affairs

(202) 457-6594

(202) 351-1399 (cell)

stjohnk@bp.com

Received(Date): Wed, 09 Jun 2010 05:55:00 -0400
From: ICC.Deputy@noaa.gov
Subject: DEEPWATER HORIZON - morning reports
To: Deepwater.HorizonDist@noaa.gov

Deepwater_Horizon_Report_52.pdf
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os_forecast_20100611_1200CDT_20100608_1900CDT_rs.pdf
landfall6_08.pdf
LoopCurrentMap-6-08.pdf
LoopCurrentStatus-6-08.pdf

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ICC Deputy

NOAA Emergency Response Division (ERD)
Report # 52: June 8, 2010 at 2000 PDT
MC 252 DEEPWATER HORIZON Incident, Gulf of Mexico, Major Spill Incident

Situation Update, Day 50:

Overview: BP has been collecting oil via the "Top Hat" for five days. The amount of oil collected increased from approximately 11,000 barrels yesterday to 14,842 in the past 24 hours. Engineers continue to work to optimize the amount of oil collected from the riser. BP should have a better handle on the final containment potential of the top hat operation within the next day or two.

Efforts to collect, burn, disperse, and contain the oil continue in full force. To date, skimmers have recovered nearly 15.86 million gallons of oily water and nearly 3.58 million gallons of oil has been burned in 131 in-situ burns. In addition, responders have deployed more than 4.80 million feet of sorbent and containment boom.

Trajectories: Onshore (SE) winds are forecast to continue through Friday at 15 knots or less. Persistent southwesterly winds last week resulted in northward movement of the slick towards the Mississippi/Alabama barrier islands and westward movement along the Florida Panhandle. Models show alongshore currents becoming more westward over the next few days, inhibiting further eastward movement of any oil. However, coastal regions between Horn Island, AL and Pensacola, FL may continue to experience limited shoreline oiling throughout this forecast period. To the west of the Mississippi delta, any remaining floating oil in this region could come ashore between Timbalier Bay and SW Pass.

Offshore Forecast: Satellite imagery analysis continues to indicate patches of sheen to the SE of the main slick. Scattered sheens and tar balls observed in this region may be getting entrained into the northern edge of the large clockwise eddy that has pinched off the main Loop Current (LC). Trajectories indicate that some of these sheens may continue southward along the eastern edge of this main LC eddy, whereas some maybe getting entrained into the counter-clockwise eddy to the NE of the main LC eddy. A CG overflight off the west coast of Florida saw no oil today. Satellite imagery of the Florida Strait and Gulf Stream saw no anomalies. However, a research vessel confirmed tarballs mixed in with seaweed along the NE edge of the main LC eddy.

Hot Topics:
Tarballs: Today, as part of a tarball monitoring effort, the R/V Walton Smith conducted a sampling cruise to the edge of the eddy that broke off of the main Loop Current. Satellite anomalies and transparent sheens seen in this area over the past few days made it a good candidate for further investigation. The R/V Walton Smith reported finding sporadic tarballs mixed with seaweed. The location of this observation was approximately 180nm WSW of Tampa Bay, FL and was along the NE edge of the main LC eddy.

Dispersants: BP continues to use dispersants on surface and sub-surface oil. To date, over 331,000 gallons of dispersants have been released near the well-head. For sub-sea dispersant use

today, the rate of release was approximately 10 gallons/minute into the oil plume. NOAA scientists are working to determine if it is possible to accurately measure water column distribution of dispersants and how to routinely incorporate dispersant testing into sample analysis. EPA has completed some nearshore sampling and did not detect dispersants. Also, BP has requested that samples from some past R/V Brooks McCall cruises be analyzed for dispersant markers.

Louisiana Berm Projects: BP announced that it will make an immediate payment of $60 million to the State of Louisiana to permit the State to begin immediate construction of berms along the barrier islands. The berms are being built to protect sensitive coastal areas from oil. NOAA provided feedback on the berm proposal raising concerns over the ability to implement the project in a meaningful time-frame and the ability to construct a stable berm over a short time frames, among other issues.

Mobile Bay Berm Project: The governor of Alabama has recently requested to build berms at the north end of Mobile Bay, AL in order to close off small inlets connecting critical habitat in the northend of Mobile Bay. NOAA has definite hydrologic, essential habitat, and endangered species concerns with this proposal. NOAA is preparing to provide potential protection alternatives in response this new proposal.

Submerged Plume Monitoring: Several vessels continue to collect information on the distribution and concentration of submerged oil. Similar to other cruise results, a few R/V Brooks McCall water samples at 1000-1400 feet and 2-4 nautical miles from the source tested positive for hydrocarbons, however concentrations were in parts per billion. The BP requested dispersant analysis has slowed the processing of the remaining R/V Brooks McCall samples.

Media and meetings:

R/V Weatherbird II Press Briefing: A joint USF and NOAA press briefing today on the water chemistry results from the R/V Weatherbird II appears to have been well received.

VIP Visit: Secretary Locke and Congressional representatives plan to visit Robert, Louisiana on Friday, June 11, 2010. Secretary Locke plans to fly onboard a NOAA Twin Otter airplane along the coast from Gulfport, MS to New Orleans, LA. This flight will be collecting multispectral imagery to help map oil locations and will help with directing clean-up efforts.

PRFA status update:

Seafood Safety	Approved
Gordon Gunter and Weatherbird II Cruises	Approved verbally, working on obtaining written documentation from FOSC
HF Radar	Being reevaluated by modelers for resubmission for funding, likely directly to BP.
Recreational Fishing	ORR and NMFS are pursuing the rec. fishing assessment as a NRDA study
Remote Sensing Activities by NGS	In review by SSC.

Thomas Jefferson / WHOI cruises for mapping sub surface areas west of the Mississippi Delta for potential hydrocarbons and dispersants	Authorization requested, response positive but funding authorization pending due to spend cap.

NOAA Roles: Many personnel are on scene and many more are engaged remotely. Additional NOAA assets are being made available for the spill.

Office of Response and Restoration (OR&R)

- Scientific support to the U.S. Coast Guard and Unified Command

Emergency Response Division (ERD)

- Predict oil fates and effects
- Overflight observations and mapping
- Identify resources at risk
- Recommend appropriate clean-up methods
- Manage data and information

Assessment and Restoration Division (ARD)

- Plan for assessment of injuries to natural resources
- Coordinate with state and federal trustees

National Weather Service

- Incident weather forecasts including marine and aviation

National Environmental Satellite, Data, and Information Service (NESDIS)

- Experimental imagery for spill trajectory forecasts
- Data Visualization

National Marine Fisheries Service (NMFS)

- Issues related to marine mammals, sea turtles, and fishery resources
- Public Affairs support to the Joint Information Center

Office of Marine and Aviation Operations (OMAO)

- USCG Liaison to the DCO Incident Support Team USCG Headquarters
- Aircraft and vessel support

Oceanic and Atmospheric Research

- Oceanographic and atmospheric modeling and data support.
- Gulf of Mexico Sea Grant programs providing technical advice on impacts to living resources and coastal communities.

National Ocean Service

- Support from ONMS for staffing and technical information
- Oceanographic modeling support
- Public Affairs support to Joint Information Center

Nearshore Surface Oil Forecast Deepwater Horizon MC252

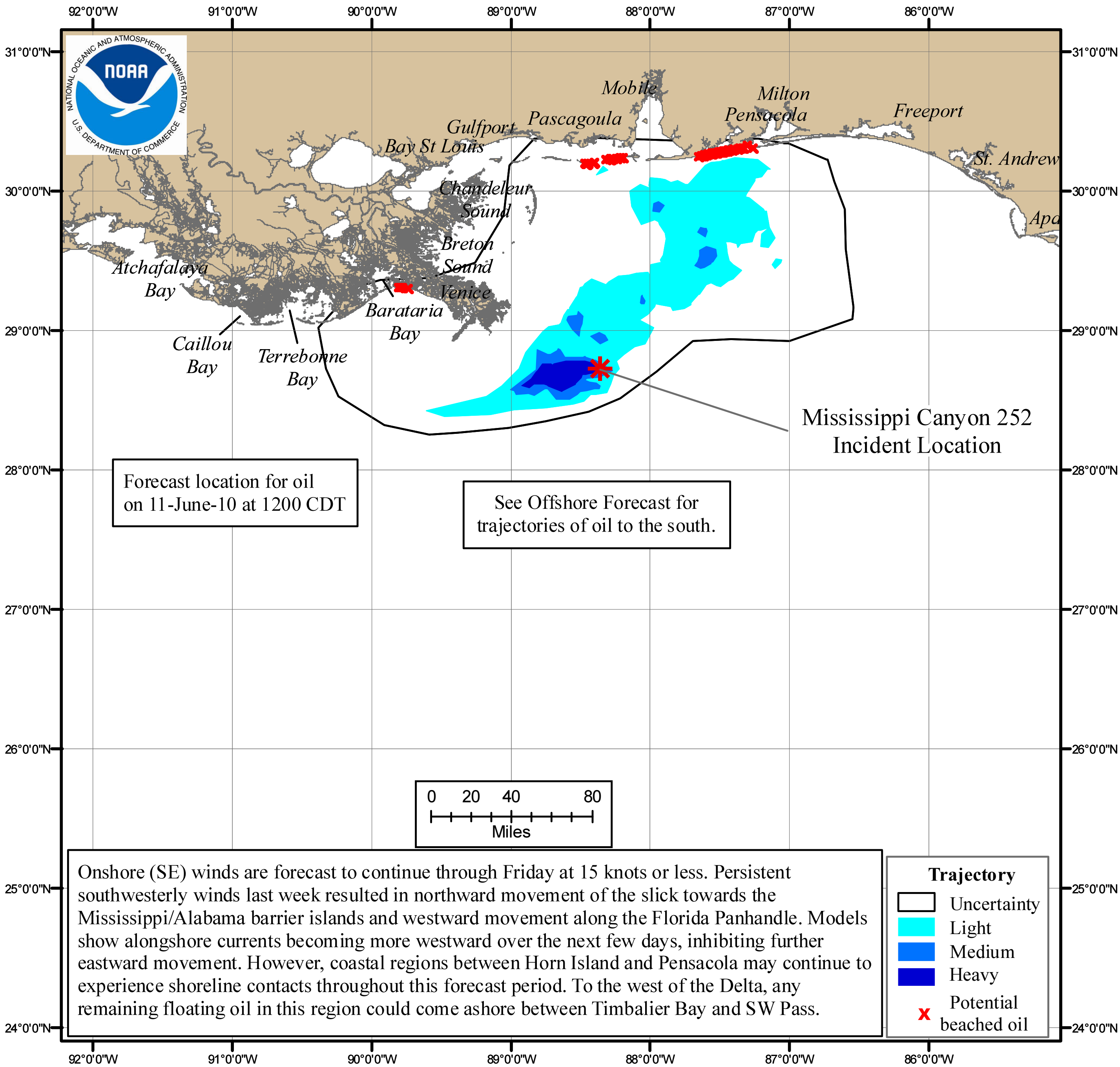
NOAA/NOS/OR&R

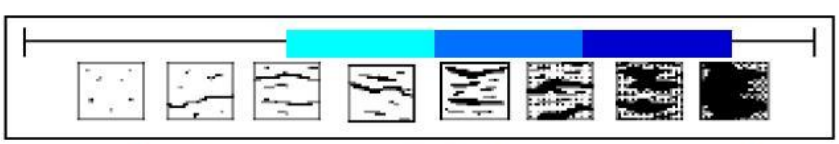
Nearshore

Estimate for: 1200 CDT, Friday, 6/11/10

Date Prepared: 2100 CDT, Tuesday, 6/08/10

This forecast is based on the NWS spot forecast from Tuesday, June 8 PM. Currents were obtained from several models (NOAA Gulf of Mexico, West Florida Shelf/USF, NAVO/NRL) and HFR measurements. The model was initialized from Monday-Tuesday satellite imagery analysis (NOAA/NESDIS) and overflight observations. The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization). Oil near bay inlets could be brought into that bay by local tidal currents.





this scale bar shows the meaning of the distribution terms at the current time

Next Forecast: June 9th PM

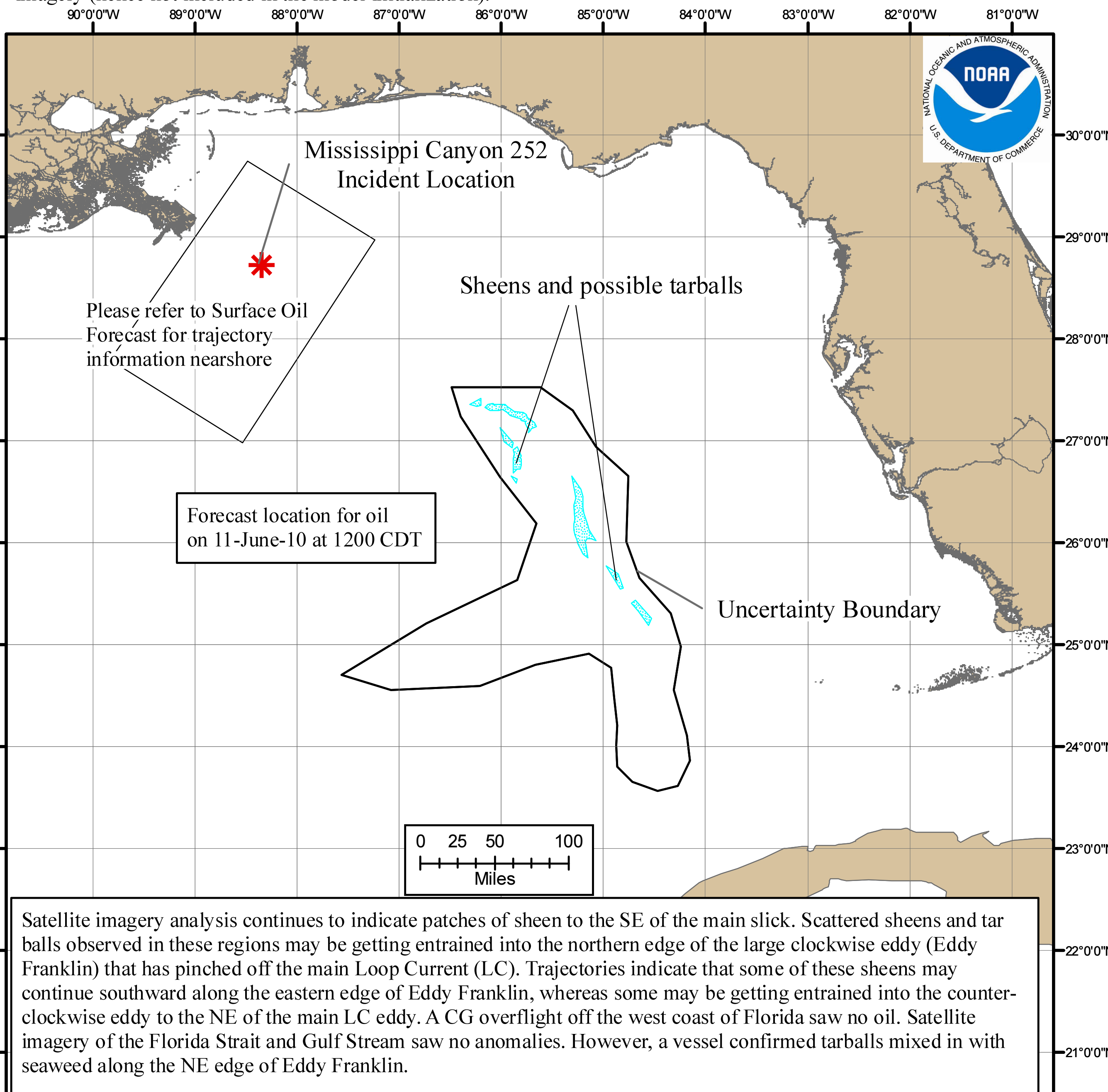
Offshore
Surface Oil Forecast
Deepwater Horizon MC252

NOAA/NOS/OR&R

Offshore

Estimate for: 1200 CDT, Friday, 6/11/10
Date Prepared: 1900 CDT, Tuesday, 6/08/10

Currents were obtained from five models: NOAA Gulf of Mexico, NavO/NCOM, NRL/IASNFS, West Florida Shelf/USF, and NC St./SABGOM. Each includes Loop Current dynamics. Gulf wide winds were obtained from the gridded NCEP product. The model was initialized from June 6/7/8 satellite imagery analysis (NOAA/NESDIS) and overflight observations from today. The leading edge may contain tarballs that are not readily observable from the imagery (hence not included in the model initialization).

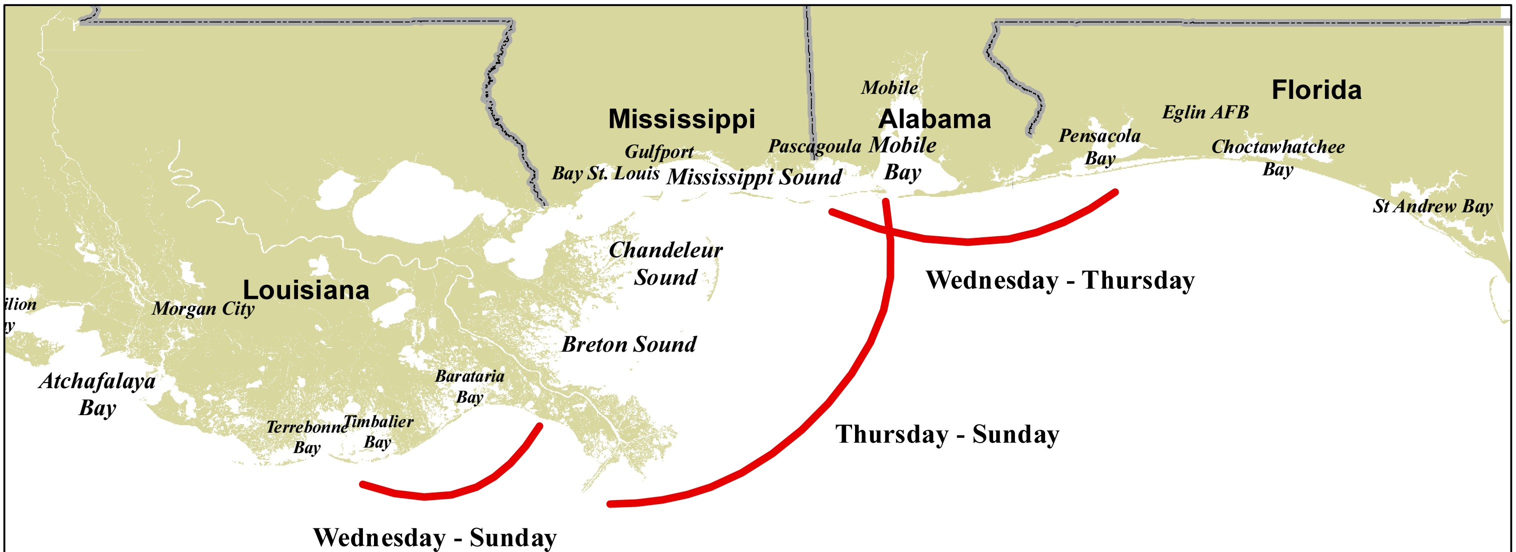


Satellite imagery analysis continues to indicate patches of sheen to the SE of the main slick. Scattered sheens and tar balls observed in these regions may be getting entrained into the northern edge of the large clockwise eddy (Eddy Franklin) that has pinched off the main Loop Current (LC). Trajectories indicate that some of these sheens may continue southward along the eastern edge of Eddy Franklin, whereas some may be getting entrained into the counter-clockwise eddy to the NE of the main LC eddy. A CG overflight off the west coast of Florida saw no oil. Satellite imagery of the Florida Strait and Gulf Stream saw no anomalies. However, a vessel confirmed tarballs mixed in with seaweed along the NE edge of Eddy Franklin.

Next Forecast:
June 9th PM

this scale bar shows the meaning of the distribution terms at the current time

Document ID: 0.7.19.2161.3



Shoreline Impact Outlook

Prepared Tuesday, June 8, 2010

This map delineates threatened shorelines for the period of June 9-13 Because of the continuous leak at the source, there is potential to impact areas multiple times. Scattered tarballs which are not observable from overflight may impact shorelines ahead of the indicated dates. Forecasting beyond three days has greater uncertainty as to potential impacts.

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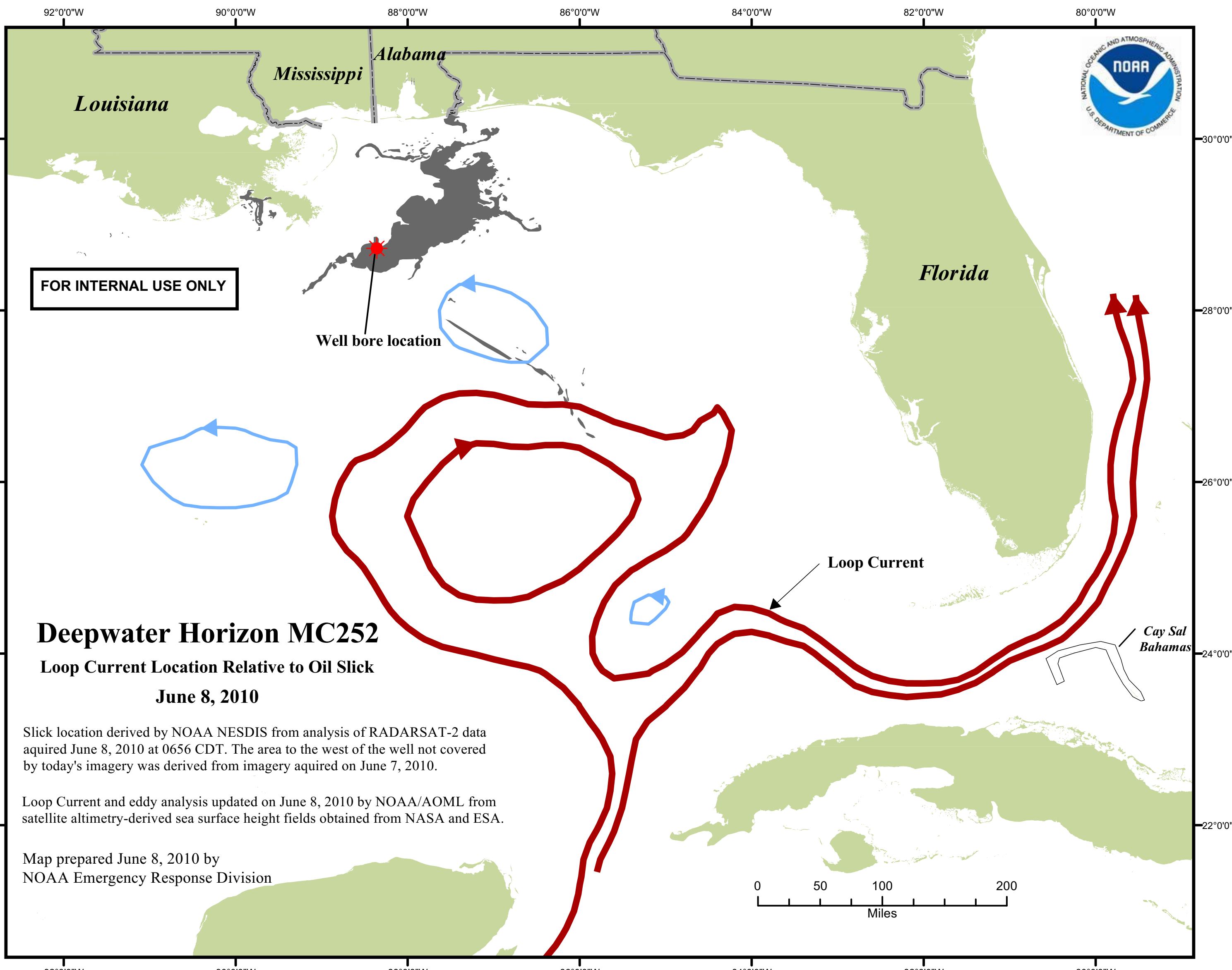
Friday - Saturday

Tuesday - Saturday

0 25 50 100
Miles



Document ID: 0.7.19.2161.5

TIME: 8:00pm CDT, June 8, 2010
TO: NOAA SSCs
FROM: NOAA Office of Response and Restoration / Emergency Response Division
Seattle, WA 98115

SUBJECT: Deepwater Horizon MC252 incident and the Loop Current

Summary The Loop Current pattern has changed to slightly increase the risk of the Loop Current serving as a mechanism to transport oil toward The Florida Straits. There continues to be no significant amounts of oil being moved toward the Loop Current. However, there has been a confirmation of a scattered tarball field at the northeast corner of the Loop Current. In addition, the northern eddy has begun to re-attach to the main Loop Current, and may completely re-join it over the next few days to a week. This provides a pathway for tarballs to move to the Florida Straits.

Observations There continues to be no evidence of high concentrations of oil in or near the Loop Current. The visible sheens near the northern edge of the Loop Current show signs of dissipating, and satellite analysis today did not observe any sheens in the loop current, Florida shelf, or Florida Current. A NOAA overflight (Jeansonne) today did not report any visible oil on the west Florida shelf or eastern edge of the Loop Current as well.

As discussed in previous reports, scattered tarball fields are generally not visible from fixed wing aircraft or satellite observations. To confirm the presence of tarballs, the vessel R/V Walton Smith traveled to the northeast corner of the Loop current, where frequent sheens had been observed in the Satellite imagery. They found “little orange particles and some bits of more aggregated red oil” at location 26°46.07’N--86°03.77’W. That location is near the boundary of the counter clockwise eddy to the northeast of the Loop Current. We expect some of the oil in that location to remain in that eddy, but some may be drawn into the Loop Current. Once in the Loop Current, some of it may remain in the large clockwise eddy, while some of it may enter the Florida Straits.

The northern eddy appears to have begun re-attaching to the main Loop Current. There is evidence of a connection to the main Loop Current on the southwestern side of the warm core eddy. In addition, some of the models and the sea surface height analysis indicate a pathway from the far eastern edge of the main eddy to the Florida Current, and passing through the Florida Straits. Two USF deployed drifter buoys have moved from the eastern edge of the northern eddy to the east, toward the Florida Straits. We continue to monitor the situation closely.

The observed tarballs are not likely to reach the Florida Straits in the next 3-4 days. The observed tarball were in an area of convergence; any oil ultimately making it to the Florida Straits will likely be far more widely scattered. In order for tarballs to reach shorelines, there must be a persistent shoreward wind to bring them to shore. At this time, we estimate that the fraction that may reach shorelines may be slightly above background levels of tarballs already on the Florida shorelines.

How we are monitoring We continue to monitor the Loop Current characteristics from a number of satellite and model sources, a vessel contracted by BP to monitor at the northern front, and buoys dropped in or near the Loop Current over the last two weeks.

The sheen that has been pulled toward the Loop Current continues to be stretched out and thinned. We do not expect larger concentration of oil to move toward the Loop Current in the near future.

A sentry plan has been developed by the Florida Peninsula Incident command. It consists of vessels transecting the Florida Current, west of the Dry Tortugas, in order to measure the tarball concentrations entering the Florida Straits. This activity should serve to provide a warning if significant tarball fields approach the Florida Straits.

What can be expected in the future It is likely that at some point in the future, another fraction of the oil will move south from the spill site. If the northern eddy has re-joined the main Loop Current, any oil moved to the northern extent of the Current will once again have a pathway to the Florida Straits and beyond. We will continue daily monitoring of the Loop Current in order to monitor this re-connection.

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ICC Deputy

Received(Date): Wed, 09 Jun 2010 16:22:55 -0400
From: Beth Lumsden <Beth.Lumsden@noaa.gov>
Subject: NOAA Science Briefing June 10
To: _HQ Deep Water Horizon Staff <dwh.staff@noaa.gov>,_DWH Science Box <DWH.Science.Box@noaa.gov>
Cc: Jen Pizza <Jen.Pizza@noaa.gov>

Please see attached

--
****

Beth Lumsden
Chief of Staff for Science
NOAA Fisheries Service
1315 East West Hwy (F)
Silver Spring, MD 20910
(301) 713-2239 x 180
Beth.Lumsden@noaa.gov

NOAA Science
Situational Awareness Briefing

Deepwater Horizon MC252

June 10, 2010

EXPERIMENTAL PRODUCT
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NOAA Science
Situational Awareness Briefing

Deepwater Horizon MC252

June 10, 2010

EXPERIMENTAL PRODUCT
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Topic Areas

- P3-Air Quality Mission
- Loop Current Dynamics
- Tarballs
- Protected Species Status
- Seafood Safety Sampling
- NOAA Assets
    - Planes, Vessels and Charters
    - IOOS update

Air Chemistry in Gulf oil spill area

Successful flight on June 8, 2010 (Tuesday)- ~ 6 hours over the spill

Key “Zeroth-order” findings:

•The spill site and surrounding have air pollution loadings of ozone and particulate matter mass, aerosol are smaller than that in LA in 1980s

•Air was relatively clean away from the spill locations.

•Aromatics were much higher than that encountered in any polluted urban areas. Total was <20 ppbv.

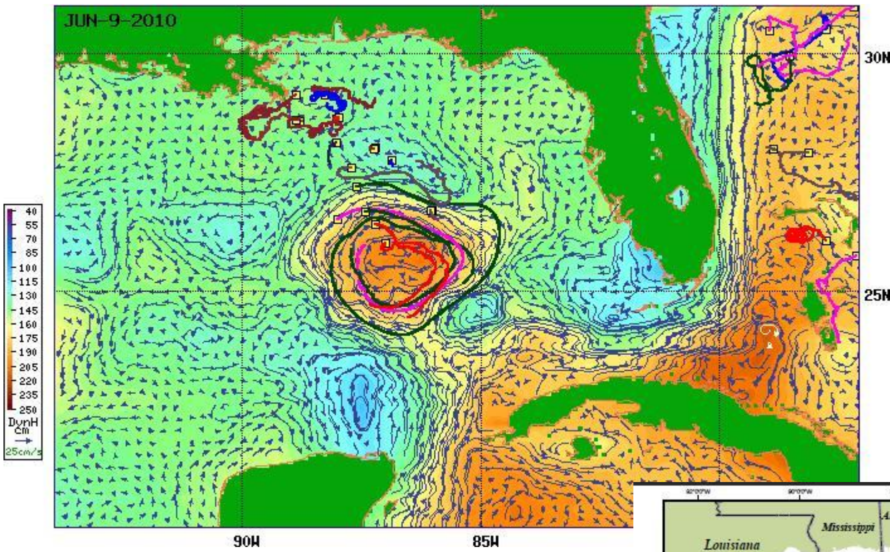
- •**OSHA and EPA need to speak to the impacts of these**.

• VERY rough estimate of the HCs evaporating from the oil slick. Consistent with expectations. It may be possible to get a better estimate if the winds are larger tomorrow. May have implications to other findings.

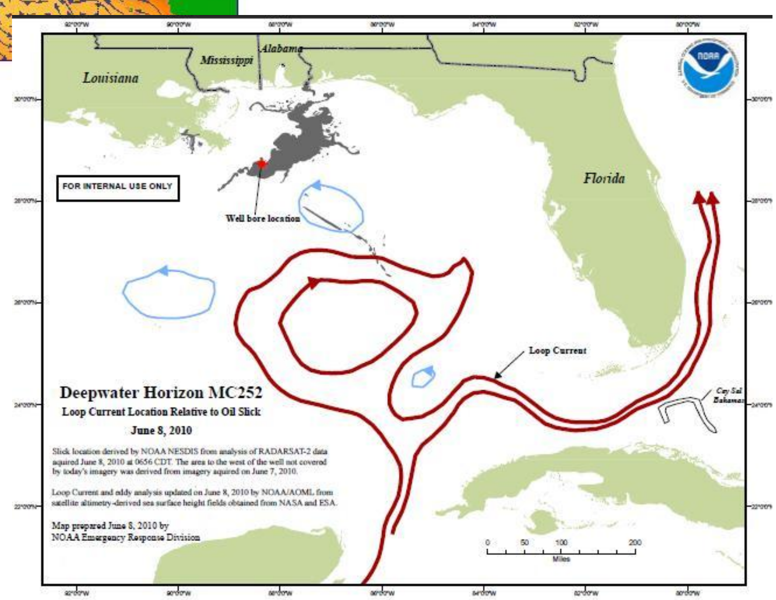
• No definitive results regarding dispersants in air at this point

• Potential unknowns for closer examination

- •detailed identification of the organic chemicals,
- •composition of aerosols and their potential health impacts.

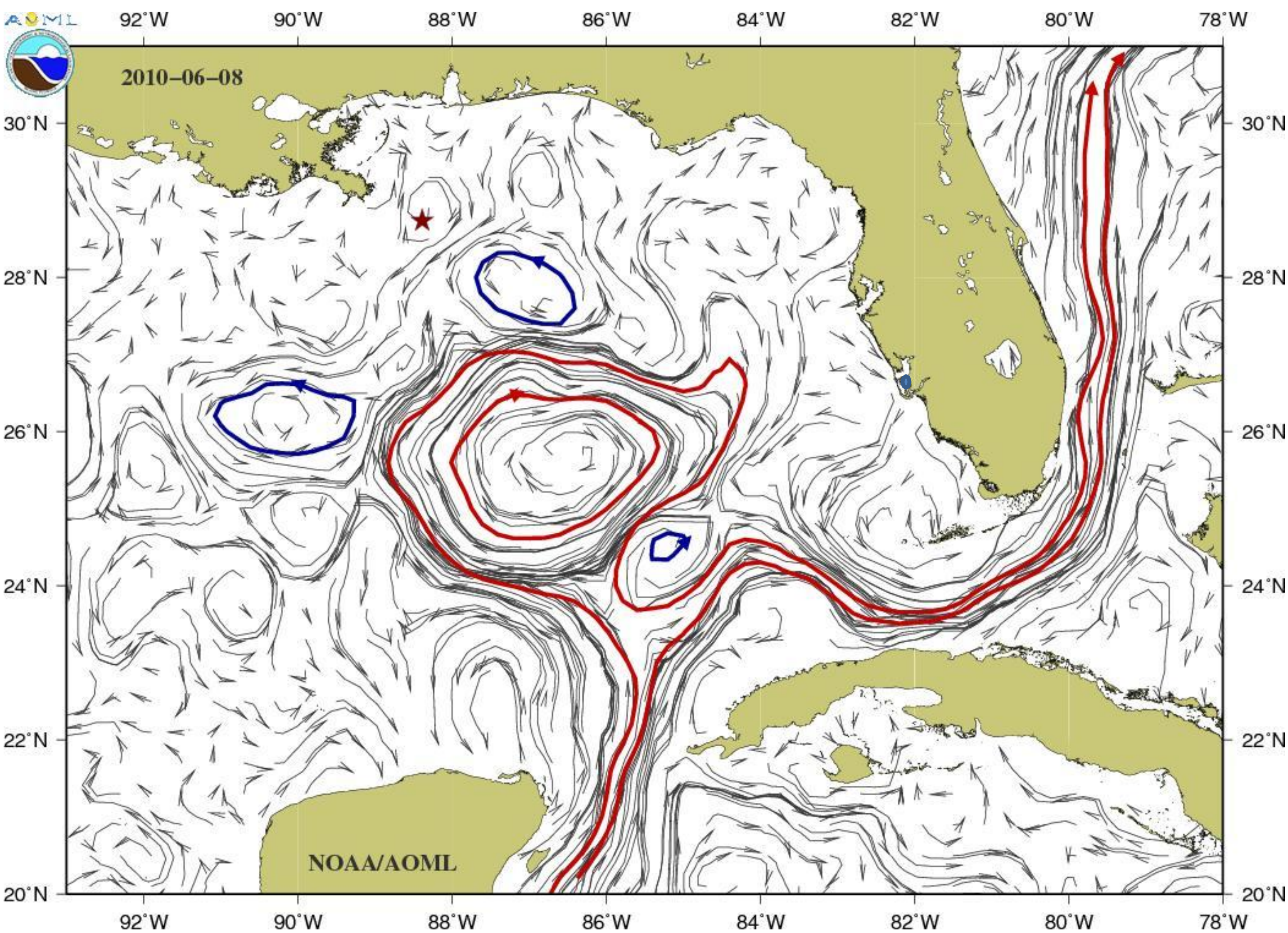


Loop Current Discussion for June 9, 2010



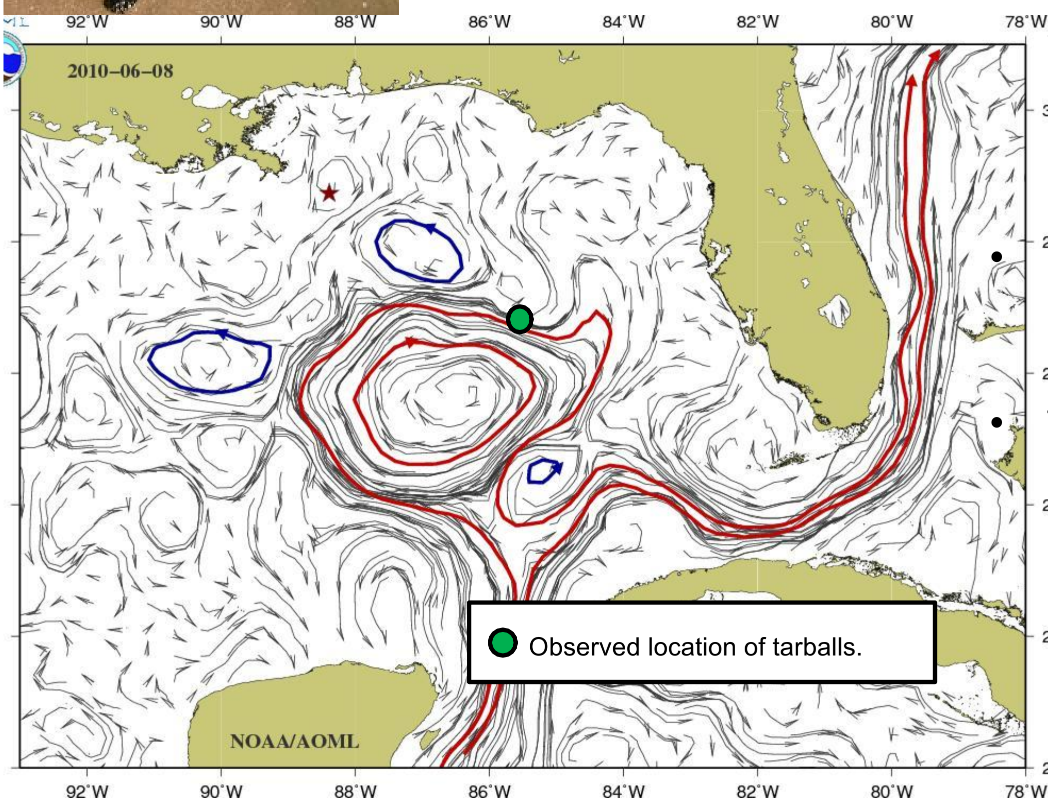
* Sea height suggests that the outer edge of the large loop eddy is reattaching to the Loop Current, and that water east of the eddy is flowing south to join the Loop Current.

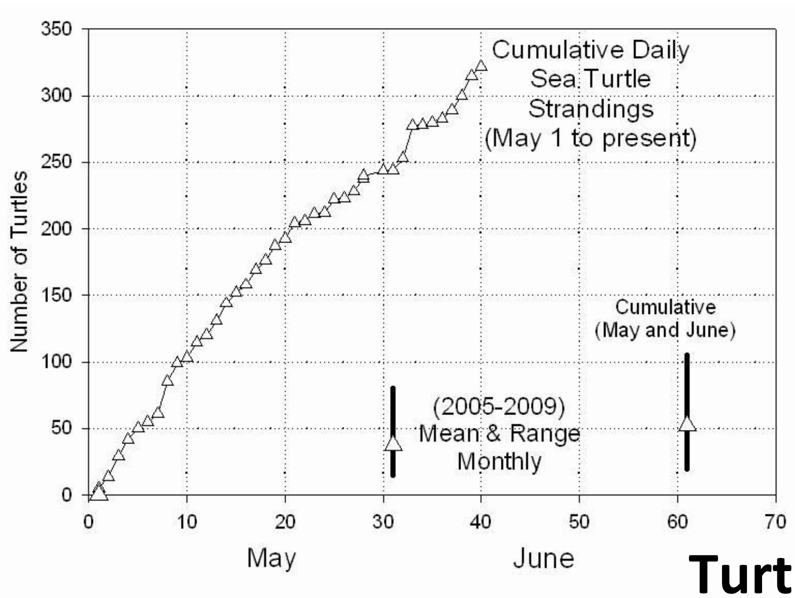
*Walton Smith confirmed tarballs near eastern side of LC, samples taken.

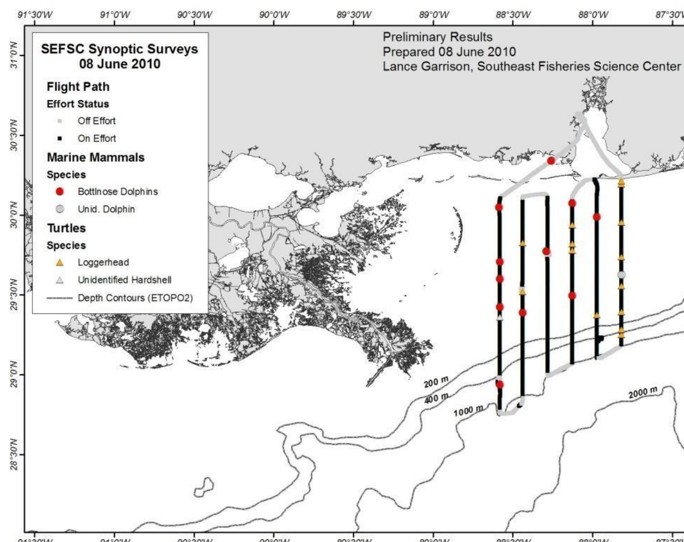

AOML
2010-06-08
NOAA/AOML
92°W
90°W
88°W
86°W
84°W
82°W
80°W
78°W
30°N
28°N
26°N
24°N
22°N
20°N

Tarballs

- R/V Walton Smith conducted a sampling cruise to the edge of the eddy that broke off of the main Loop Current.
- Satellite anomalies and transparent sheens seen in this area over the past few days made it a good candidate for further investigation.
- Sporadic tarballs mixed with seaweed were reported.
- The location of this observation was approximately 180nm WSW of Tampa Bay, FL and was along the NE edge of the main LC eddy.

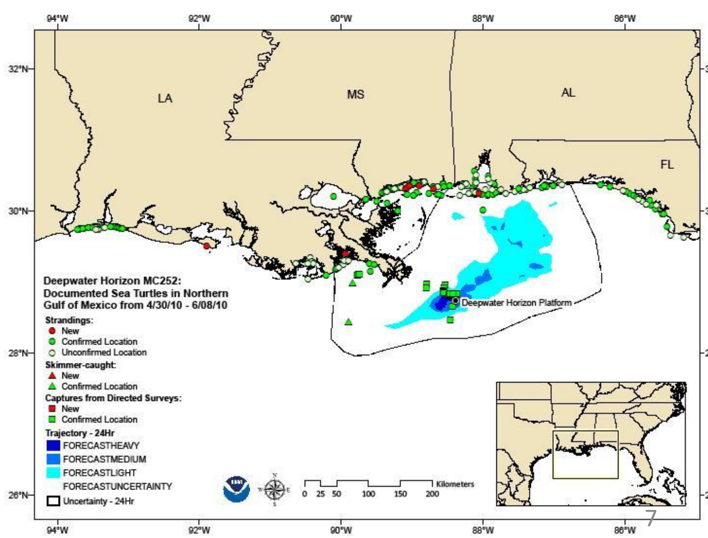


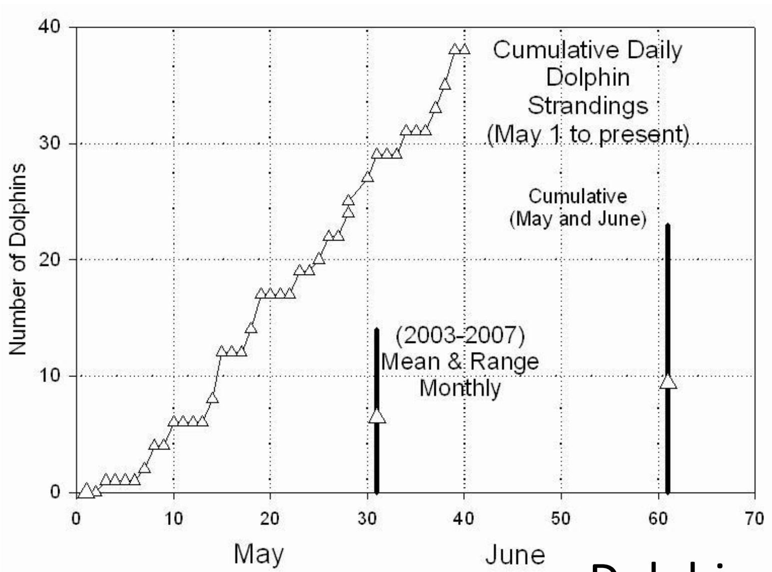


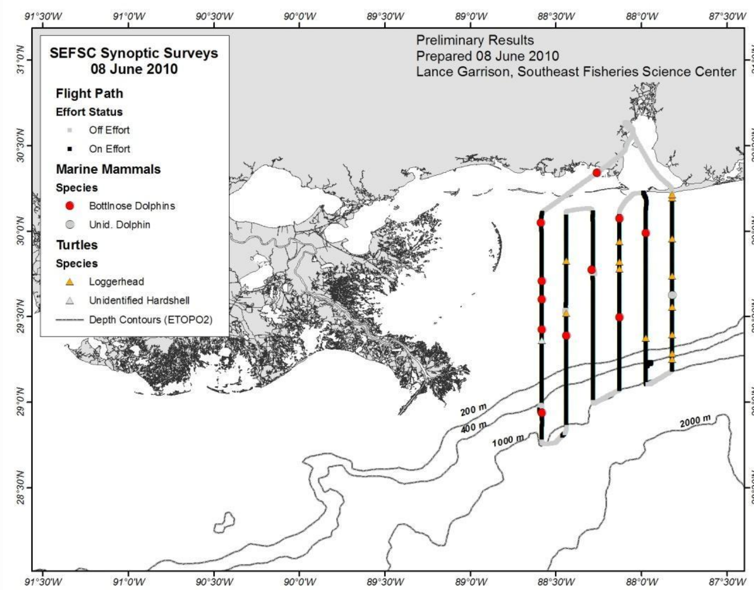


Turtles

Turtle Status	
Total Verified Stranded Turtles	**322**
Total stranded turtles found dead	272
Total live stranded turtles currently in rehabilitation	41
Total live stranded turtles that died in rehabilitation	6
Total live stranded turtles released	3
Turtle Necropsy Status (of dead animals)	
Number assessed and unable to perform necropsies (e.g., advanced decomposition)	7
Number of partial necropsies performed (e.g., due to scavenging or autolysis)	17
Number of full necropsies performed	55
Verified strandings but animals not collected due to stage of decomposition or unable to recover	46
Carcasses to be necropsied, if decomposition stage warrants	153

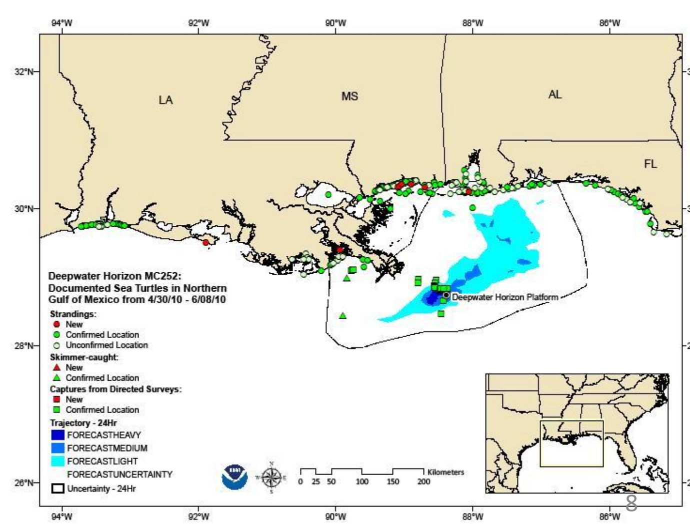


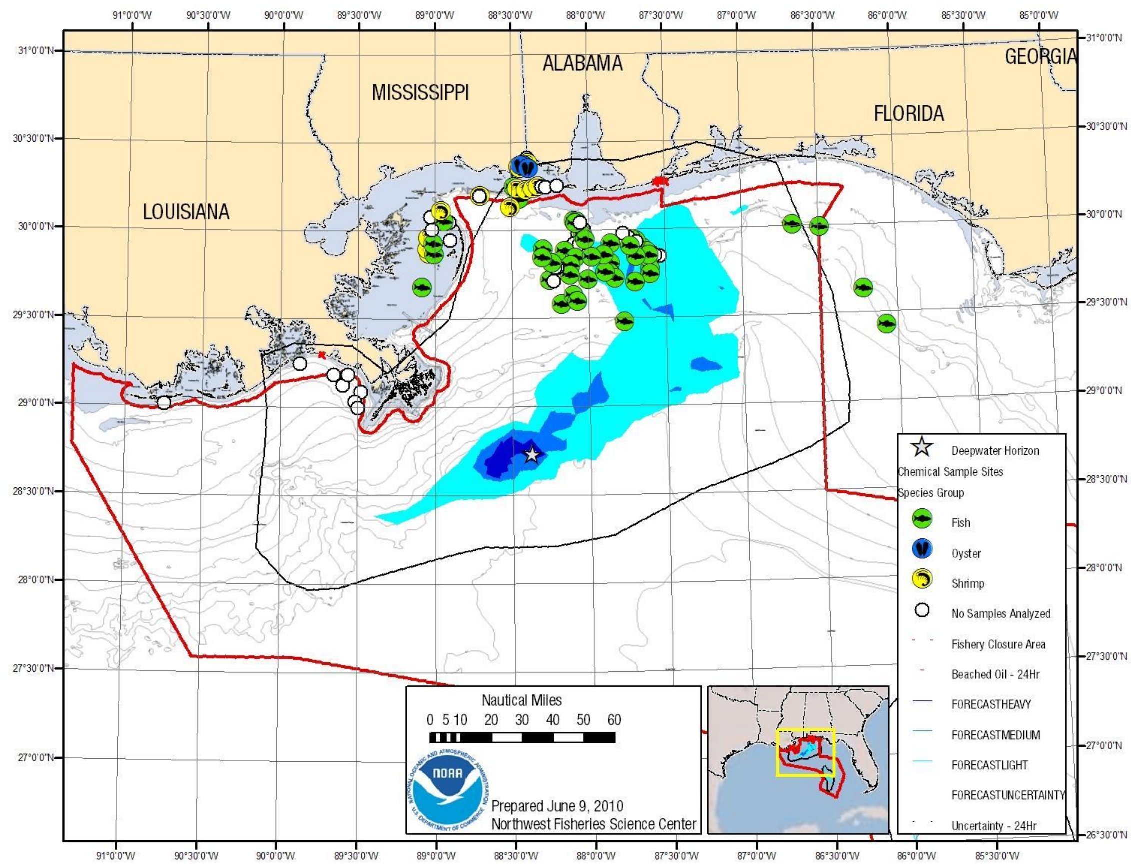




Dolphins

Dolphin Status	
Total Verified Dolphins	**38**
Total dead stranded dolphins	36
Total live dolphins currently in rehabilitation	0
Total live dolphins stranded that died in care	2
Total live released dolphins	0
Dolphin Necropsy Status (of dead animals)	
Number assessed and unable to perform necropsies (e.g., advanced decomposition)	13
Number of partial necropsies performed (e.g., due to scavenging or autolysis)	9
Number of full necropsies performed	6
Verified strandings but animals not collected due to stage of decomposition or unable to recover	9
Carcasses to be necropsied, if decomposition stage warrants	1

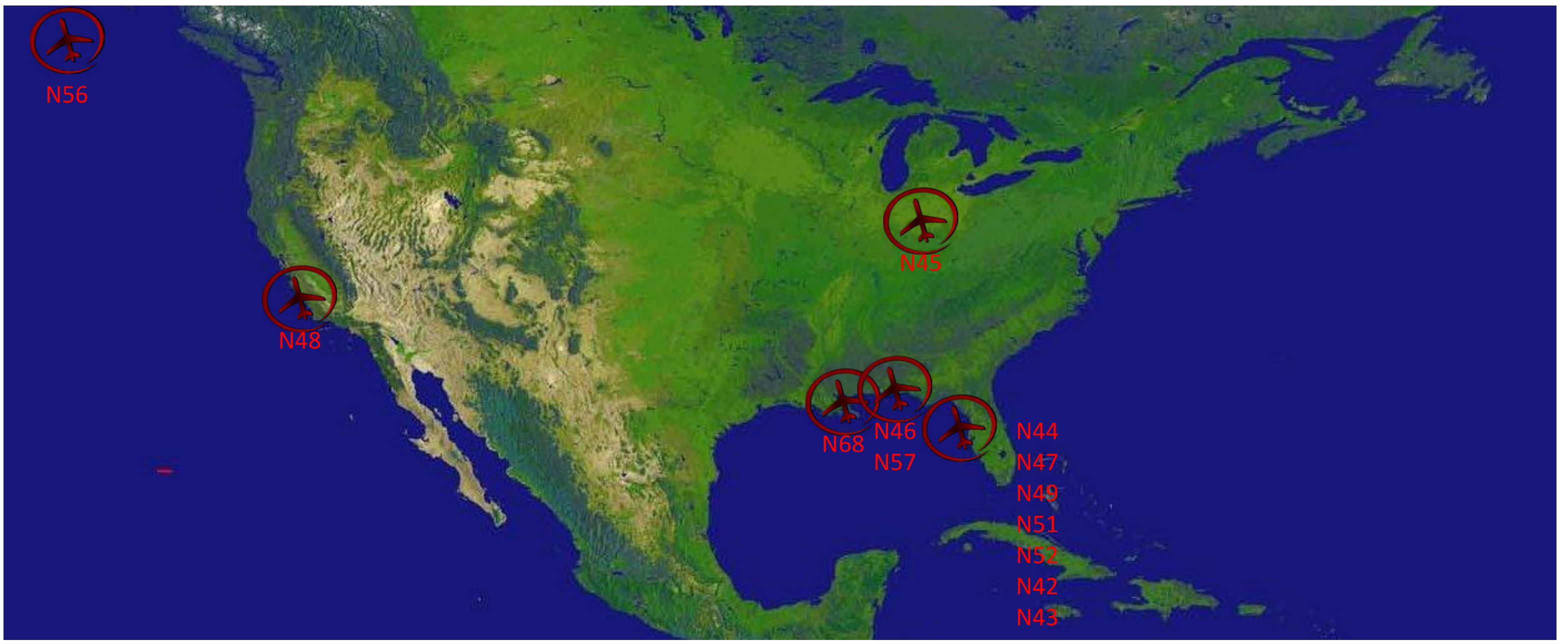




June 9, 2010

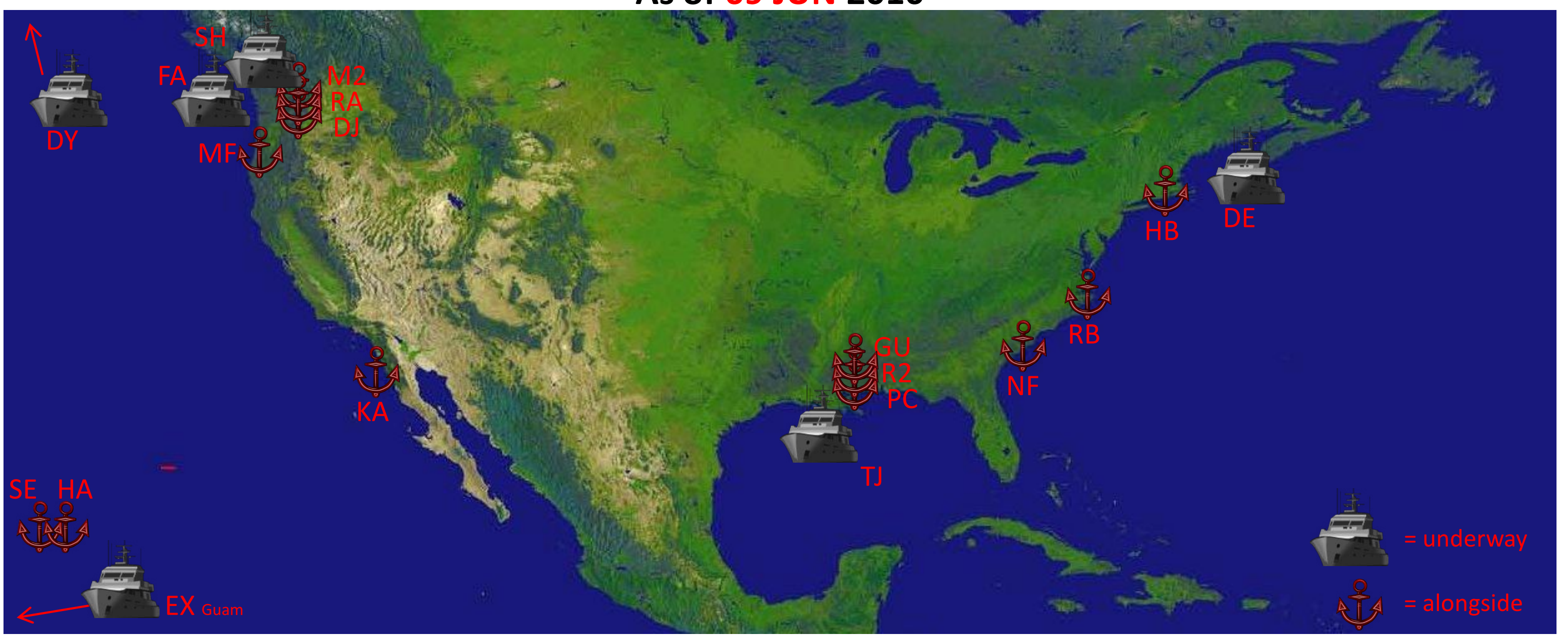
- Another set of 12 fish and shellfish composite samples will be analyzed by GC/MS today.
- Preparation of additional sets of fish and shellfish samples for chemical analysis are ongoing.

NOAA Aircraft Positions
As of 09 JUN 2010



ID	Type	Status Today
N42	P-3	No flight, MacDill AFB
N43	P-3	Hard Down Day, No flight, MacDill AFB
N44	P-3	Maintenance, MacDill AFB
N45	Turbo Cmdr	Maintenance, Indianapolis, IN
N46	Twin Otter	DWH multi-spectral scanning / oil density and thickness, Mobile, AL
N47	Shrike	Maintenance, MacDill AFB
N48	Twin Otter	CALNEX, Ontario, CA
N49	G-IV	Tail Doppler Radar install/testing, Ardmore, OK
N51	Shrike	No flight, MacDill AFB
N52	Citation	In disposal process, MacDill AFB
N56	Twin Otter	MMS marine mammal survey, Sitka, AK.
N57	Twin Otter	DWH marine survey in Mobile, AL
N68	King Air	DWH coastal photography / mapping, New Orleans, LA

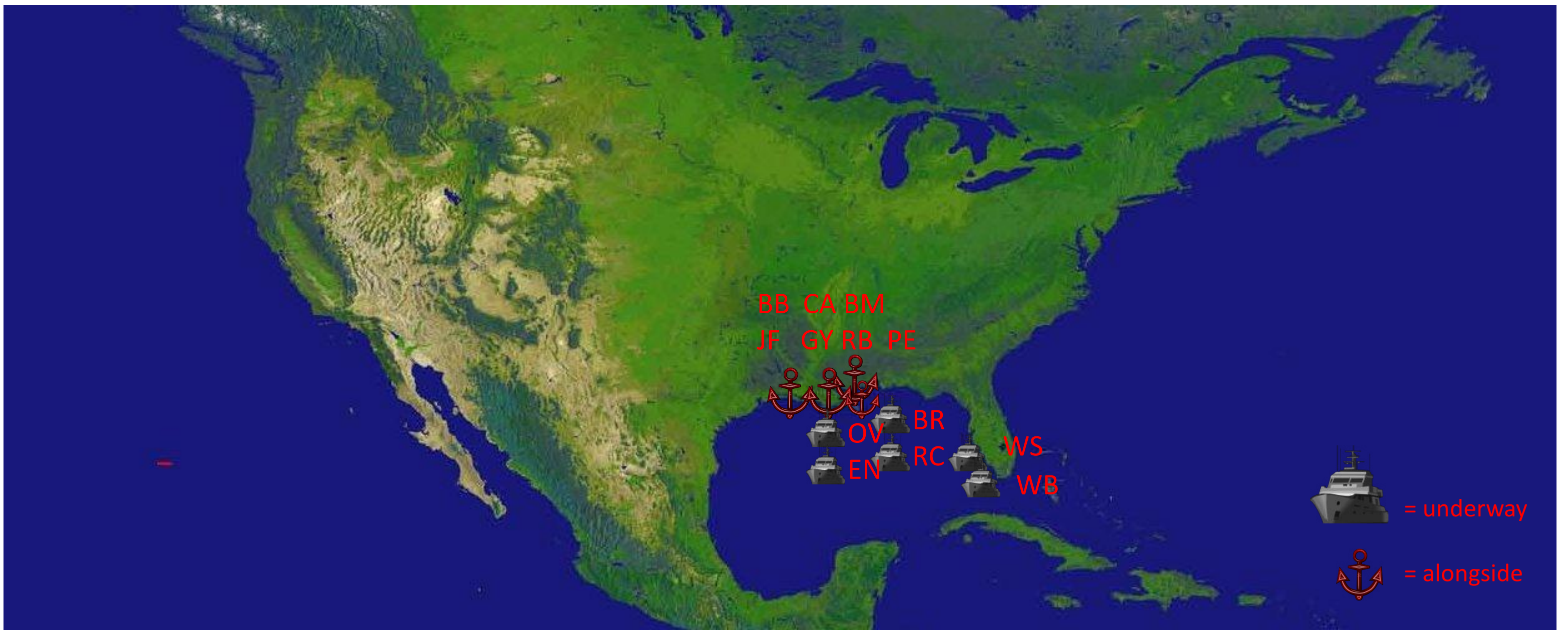
NOAA Ship Positions
As of 09 JUN 2010



ID	Status Today
FA	Underway on scheduled project. Arrival 6/18 Port Angeles, WA
SH	Underway on scheduled project. Arrival 6/9, transit to Seattle, WA
MF	Alongside Astoria, OR. Departure 6/9 for scheduled project.
DY	Underway on scheduled project. Arrival 6/24 Dutch Harbor, AK
HI	Alongside Pearl Harbor, HI. Departure 6/9 for scheduled project
M2	Alongside Seattle, WA. Departure 6/9 for scheduled project
SE	Alongside Pearl Harbor, HI. Departure 7/6 for scheduled project
KA	Alongside San Diego, CA. Departure 7/8 for scheduled project
RA	Alongside Cascade, OR for shipyard repair period
DJ	Alongside Seattle, WA. Decommissioning on week of 7/26
EX	Underway on scheduled project. Arrival TBD, pending Indonesian clearance

ID	Status Today
DE	Underway on scheduled project. Arrival 6/10 Woods Hole, MA
TJ	Underway on DWH “Western Sentry”. Arrival 6/11 Galveston, TX
HB	Alongside Newport, RI. Departure 6/22 for sea trials
NF	Alongside Charleston, SC. Departure 6/18 for scheduled project
RB	Alongside Norfolk, VA. Shipyard repair contract ends 8/13
GU	Alongside Pascagoula, MS. Departure 6/14 for scheduled project
PC	Alongside Pascagoula, MS. Departure 6/14 for scheduled project
R2	Alongside Pascagoula, MS. Departure 6/15 for scheduled project

Chartered Vessels and NOAA Small Boats
As of 09 JUN 2010



ID	Type	Status Today
BR	F/V Beau Rivage	Coastal mapping off of FL
BM	R/V Brooks McCall	Inport Port Fouchon
BB	M/V Bunny Bordelon	Inport Houma
CA	R/V Caretta	NOAA Small Boat alongside Pascagoula. DWH begin 21 June
EN	R/V Endeavor	Transit to FL
GY	R/V Gandy	Inport Pascagoula for mechanical problems. Return to operations estimated 14 June
JF	R/V Jack Fitz	Inport Golden Meadow
OV	R/V Ocean Veritas	2.5km SSE of wellhead, deep water sampling
PE	R/V Pelican	Inport Chauvin, LA
RB	M/V Rachel Bordelon	Inport Houma, LA. Departing at 2300 for ACDP Buoy Deployment 2.5km north of wellhead
RC	R/V Ryan Chouest	Shallow water (5m) sampling for hydrocarbons, moving westerly
WS	R/V Walton Smith	Survey/sampling leading edge of forecast surface plume in "tiger tail"
WB	R/V Weatherbird II	Underway – non oil spill ops

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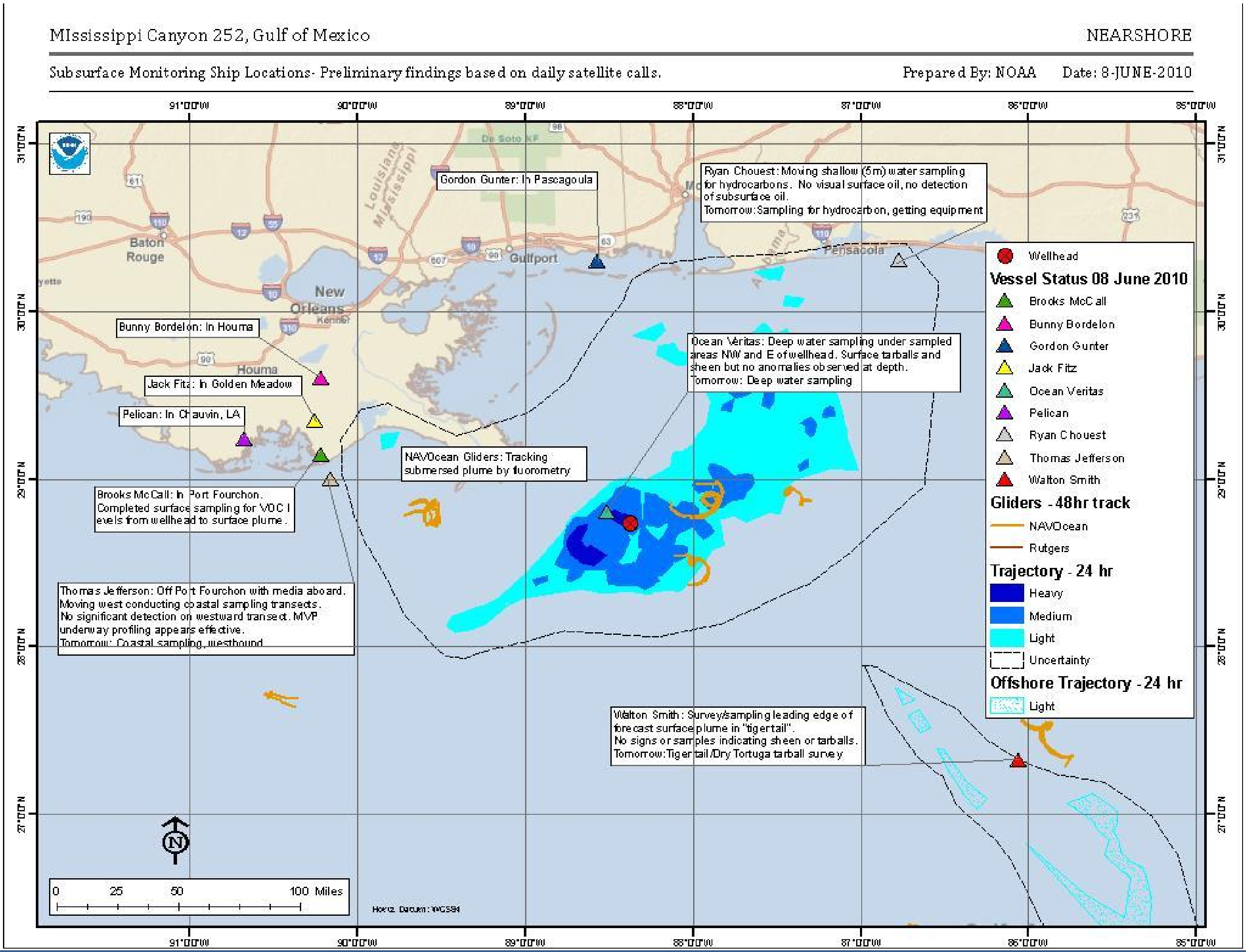
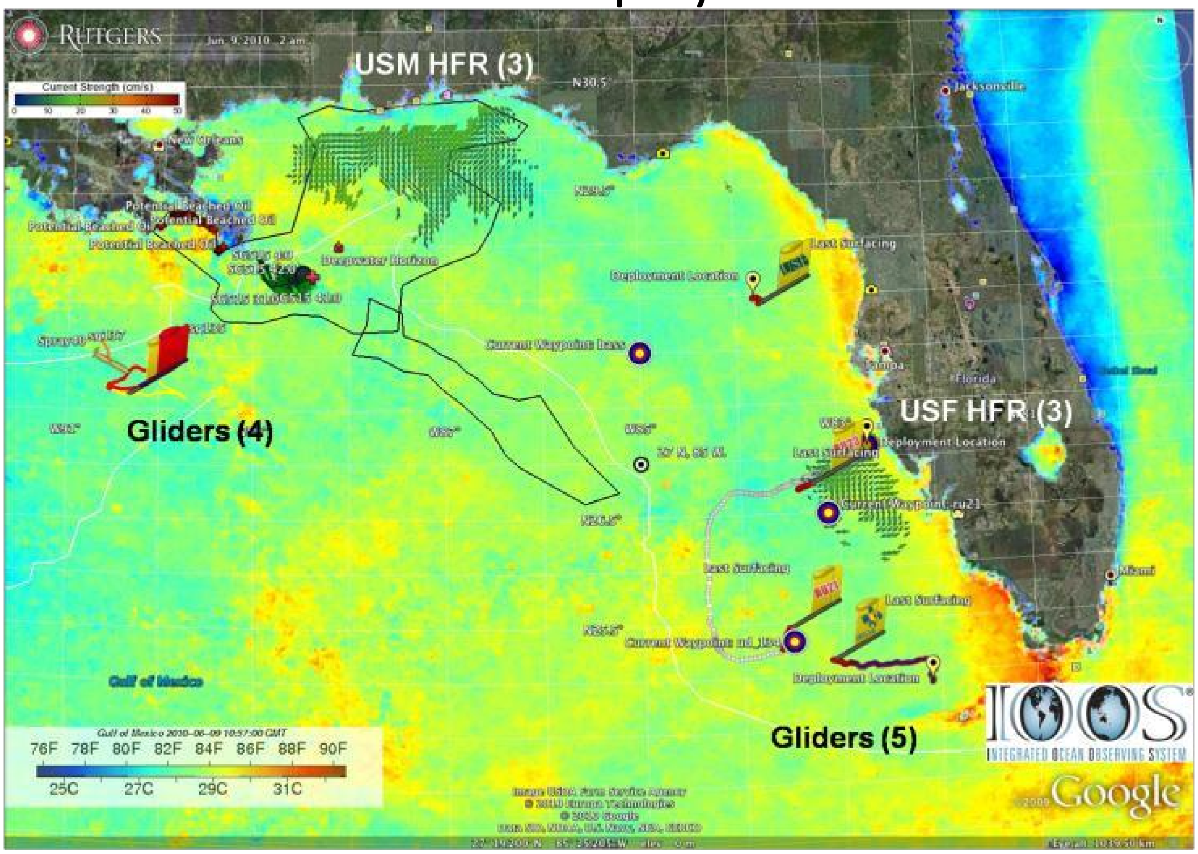


https://www.st.nmfs.noaa.gov/confluence/display/OOP/Sub+Surface+Monitoring+Ship+Locations

Vessel Assignments for June 9-11, 2010

Vessel	Type	Compliment	Latitude	Longitude	Operations for June 8	Operations for June 9	Operations for June 10	Findings
Beau Rivage	109 ft F/V	6			Coastal sampling off FL	Coastal sampling off FL	Coastal sampling off FL	
Brooks McCall	162 ft ROV Ops	32	29 08.6N	90 12.8W	In Port Fourchon	Depart Port Fourchon	Deep water sampling	
Bunny Bordelon	150 ft OSV	16	29 35.9N	90 12.8W	In Houma	In Houma	In Houma	
Endeavor	185 ft				Transit to FL	Transit to FL	Transit to FL	
Gordon Gunter	224 ft R/V	33	30 18.0N	88 34.0W	In Pascagoula	In Pascagoula	In Pascagoula	
Jack Fitz	165 ft OSV	26	29 20.9N	90 14.8W	In Golden Meadow	Departing for deep water sampling	Deep water sampling	
Navocean Sea Gliders	2 AUV's				Monitoring and sampling oceanographic conditions	Monitoring and sampling oceanographic conditions	Monitoring and sampling oceanographic conditions	
Ocean Veritas	194 ft M/V	41	28 42.9N	88 21.7W	Deep water samplin, 2.5 km SSE of wellhead, heading 2.5 km SW	Deep water sampling	Deep water sampling	No subsurface oil detected
Pelican	116 ft R/V	16	29 14.3N	90 40.2W	In Chauvin, LA	In Chauvin, LA	In Chauvin, LA	
Rachel Bordelon	150 ft	20	29 35.9N	90 12.8W	In Houma, departing 2300	ADCP Bouy Deployment, 2.5 km North of wellhead	In Houma	
Rutgers and USF gliders	3 AUV's				Monitoring FL coastal waters from Tampa to the Keys	Monitoring FL coastal waters from Tampa to the Keys	Monitoring FL coastal waters from Tampa to the Keys	
Ryan Chouest	215 ft OSV		29 35.8N	88 12.4W	Shallow (5m) water sampling for hydrocarbons, moving westerly	Departing Theordore, AL for subsurface (150m) sampling for hydrocarbons	Subsurface (150m) sampling for hydrocarbons	Orange/brown oil cakes, little subsurface anomalies
Thomas Jefferson	208 ft R/V	33	28 21.9N	91 47.8W	MVP transects for coastal sampling, westbound	Arrive Galveston, TX	In Galveston, TX	Anomalies on flourometer at 25-40m depth off Alabama, Delta and Port Fourchon
Walton Smith	96 ft R/V	19	26 22.9N	84 17.4W	Survey/sampling leading edge of forecast surface plume in "tiger tail".	Arriving Key West for repairs	Transit to Miami	Long, patchy oil sheens along 86W longitude, tar "blobs"
Weatherbird II	115 ft R/V	20			Underway-Non-Oilspill	Underway-Non-Oilspill	Underway-Non-Oilspill	

US IOOS® Assets deployed 9June



Gliders (9) : IOOS Partners: MACOORA (Rutgers, U Del); SECOORA (USF); GCOOS (USM) ; SCCOOS (new); US Navy (2). Note USF recovered Sam and deployed Waldo

High Frequency Radars (6) – Surface currents : IOOS Partners GCOOS (USM); SECOORA (USF)

Drifters (10) : Horizon Marine – not shown on the map

Data: http://rucool.marine.rutgers.edu/deepwater/